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ENTERED AT POST OFFICE, NEW YORK, AS SECOND CLASS MATTER.

Combined Boring and Bit Mortising Machine.

This machine is designed for use in any shop where boring or mortising is done. The main spindle, of steel, is fitted with a self-centering chuck with hardened steel jaws that will take any bit shank up to $\frac{5}{8}$" diameter.

The table has horizontal movement of six inches, on ways, and a vertical adjustment of ten inches, by means of a hand crank and screw, all the ways being provided with gibs for taking up wear.

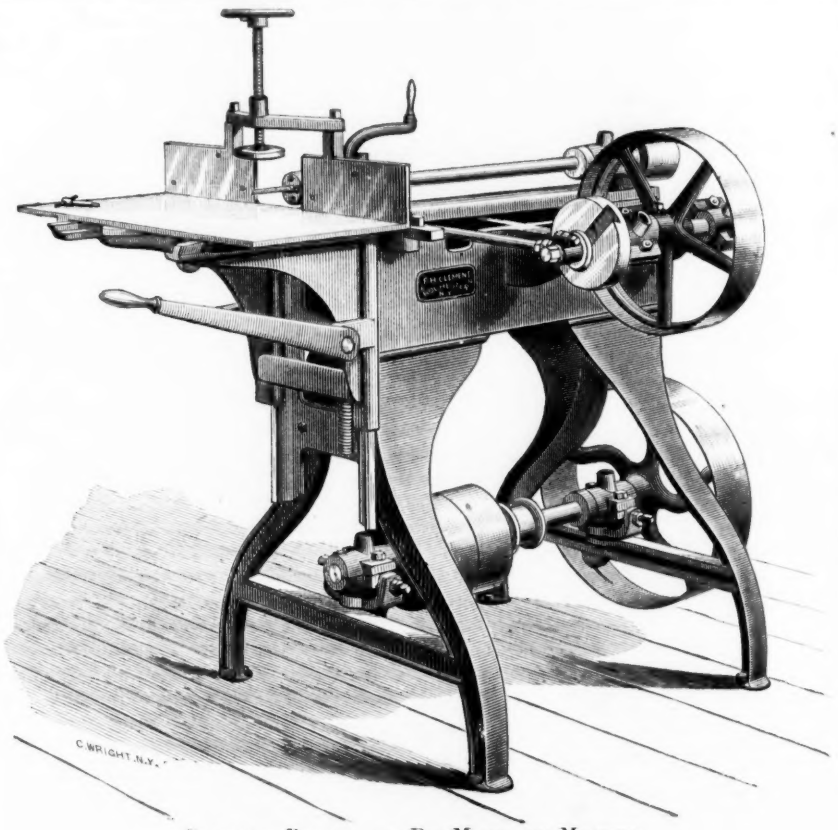
A stop gauge under the table limits the depth of cutting.

For mortising, the hand-lever under the table is used, but for boring, it may be detached, if preferred, by removing a joint-screw. The clamp shown in the cut is used for square work, but this may be varied to order, for different classes of work.

The crank-shaft is solidly boxed on arms projecting from the bed of the machine, the latter being cast in one piece, so that none of the parts can get out of line. The center of vibration of the main spindle is directly under the center of the pulley. The crank-pin is easy of access for adjustment, and is held absolutely rigid when set. For chair and other light work that has to be handled fast, a quick acting, eccentric clamp is provided, which is adjustable for different kinds of work and clamps the stock instantaneously at either one or two points as desired; this is usually attached to a hard-wood table glued up in strips. The base of the machine is broad and can not tremble on a reasonably good floor. All revolving parts are carefully balanced.

The counter-shaft is usually located on the machine, as shown, but it may be hung in hangers overhead, if so ordered.

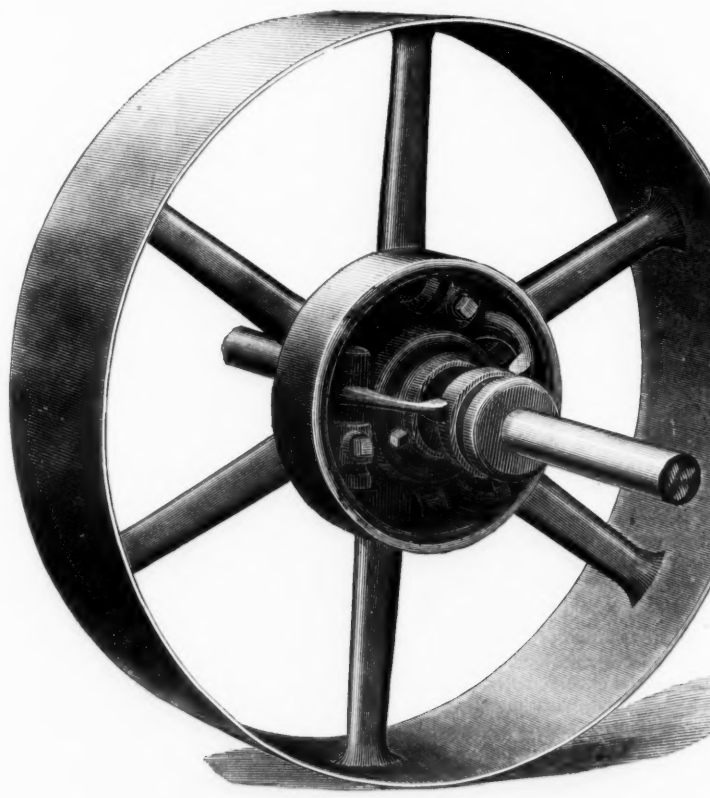
This machine is made by Frank H. Clement, 115 Mill street, Rochester, N. Y.



COMBINED BORING AND BIT MORTISING MACHINE.

A Persian Industry in Warlike Antiquities.

Although Persia, like many other oriental countries, has lain for centuries in a sort of comatose condition, the time was, as all readers of history know, when that country was first in the arts of war and peace. An art in which Persian blacksmiths attained great perfection was the forging of sword blades, the Khorassan sword with its wavy steel having rivaled in temper and strength the famous Damascus swords. Of late years there has been small use in Persia for anything of a warlike nature, and the natives have readily parted with their best ancient swords to western curiosity collectors who were ready to give hard cash in exchange. By degrees a demand arose among antiquaries and virtuosos for Persian swords, and other ancient articles of warfare, also increased in value by having a market. The trade was pushed so actively that the supply began to run short, and then the modern Persians displayed enterprise worthy of the descendants of the great Cyrus. With true oriental shrewdness, they reasoned that since the supply of old weapons was getting exhausted, new articles made to imitate the old ones would suit as well, if they could succeed in decieving their customers into the belief that the new was old. They succeeded. Then they entered systematically into the manufacture of ancient warlike articles. Free from the competition of Manchester and Sheffield, this Persian industry prospered, and to-day Ispahan shops are doing a lucrative business of carved and inlaid helmets, breast plates, swords and bucklers, every article looking as if it had borne the moisture and wear of centuries. A recent consular report gives many interesting details of this business, and describes the artistic skill displayed by the Persian workmen.



NEW FRICTION CLUTCH.

Blevney's New Friction Clutch.

Friction clutches for connecting and disconnecting shafts and parts of machines and machinery have almost entirely superseded the old interlocking or positive clutch, the latter, always unsatisfactory, having become an element of danger in causing breakage as the speed of machinery has been increased. They have also largely done away with the use of fast and loose pulleys, generally saving space and providing for better effect in belt transmission. The engraving on this page represents a new friction clutch, the invention of J. C. Blevney, and manufactured by the Blevney Manufacturing Company, 56 Academy Street, Newark, N. J. In this clutch the usual loose pulley is employed; but the hub, instead of being shortened, is of a length corresponding to the width of the face of the pulley, thus giving a bearing in line with, and directly opposed to, the pull of the bolt. Adjoining this hub, and overlapping it so as to prevent the escape of oil to the friction surfaces, is a collar fastened to and revolving with the shaft. On this collar, and guided by it, are three sectors, together forming what may not inaptly be called an expanding pulley. These sectors are held in position, inwardly or towards the center, on the collar, by means of an annular coil spring. The sectors are made with recesses into which bosses on the collar fit loosely, preventing the sectors from revolving around the collar. Between the sectors the three actuating levers are pivoted. One face of the pivoted end of each of these levers is cam-shaped, and works against the correspondingly shaped face of a detachable collar secured in the sector. The other ends of the levers extend to a collar adapted to be moved longitudinally on the shaft, by the operation of which the cam surfaces spread, or expand the sectors radially, bringing the friction surfaces into contact and locking the pulley to the sectors and fast collar. A movement of the sleeve in the opposite direction disengages the frictional surfaces, and the spring previously referred to returns the sectors to their original or inoperative position.

It will be understood that in expanding the sectors the hole at the center is correspondingly enlarged, the sectors, as it were, floating in space until their outer surfaces come in contact with the frictional surface of the loose pulley, so that, being unrestrained at the center, an equal pressure is brought to bear in all directions, leaving the sliding collar entirely free on the shaft, the final action being the same as if the pulley were clamped by its inner surface in a three-jawed chuck, where neither jaw can hold till all are in equal contact. This does away with all adjustment to bring about equal bearing of parts, as well as friction when the bearing is not equal, so that a pulley locked in this way

carries its shaft like the old interlocking clutch pulley, the lugs on the collar and the recesses in the sectors operating substantially like the clutch horns. At the same time the noise and danger of the old device are avoided.

The cam-faced collars are held in position in the sectors by set screws, and by slightly changing their position any lost motion from wear may be taken up, it not being necessary, as previously explained, to equalize them, moving one collar generally being sufficient. The sliding sleeve is not splined or otherwise secured to the shaft, and moves substantially frictionless upon it. A very easy motion suffices to firmly clutch the pulley, moving the sliding collar by hand—that is, without the usual lever—giving sufficient friction to hold a pulley even under heavy work.

Although, as here shown, the friction is applied to a pulley, it will be evident that it is equally applicable to drums, or for other purposes where the use of a friction clutch is desirable. The arrangement and construction of parts are quite simple, and there would seem to be but little liability to derangement.

Cyrus H. McCormick.

By the death of Cyrus H. McCormick, which happened in Chicago May 13, the country loses a pioneer who labored successfully in developing an important American mechanical industry. Cyrus Hall McCormick was born in Virginia in 1809, and his youth was spent on a farm owned and worked by his father. In these times agricultural machinery retained the primitive shape, not much removed from the types used by the ancient Egyptians, human muscle being the machine that did the heavy toil of farm operations.

During the boyhood of McCormick, in the hot harvest field, the ancient sickle was still the principal implement wielded by the reaper, and the form of the tool combined with the position necessary in using it, made a day's labor in the field exceedingly toilsome. The mechanical talent of several States and nations had already begun to labor on the problem of devising a machine where horse labor could be applied to aid the reaper. McCormick was of an ingenious turn, with good inventive faculties, and as a boy he devoted his attention to producing an improvement on the sickle.

First he got out a reaping cradle, which was well received. His father, who had some mechanical ingenuity, worked for about fifteen years trying to produce a reaping machine, but finally threw it aside as impracticable. The son then took hold of the abandoned machine and made some radical changes, which improved its operation so much that the way of success seemed opened. For several years longer he experimented with the machine, applying it to reaping on his father's farm, and in actual operation noting the defective or weak points which needed change or increased strength. His energy, patience, and perseverance eventually met with reward in the complete success of the machine.

So soon as the machine was put on the market, it rapidly met with favor. This invention contributed more than any other single machine to develop American agriculture, and to place this country in the front as a grain-producing nation.

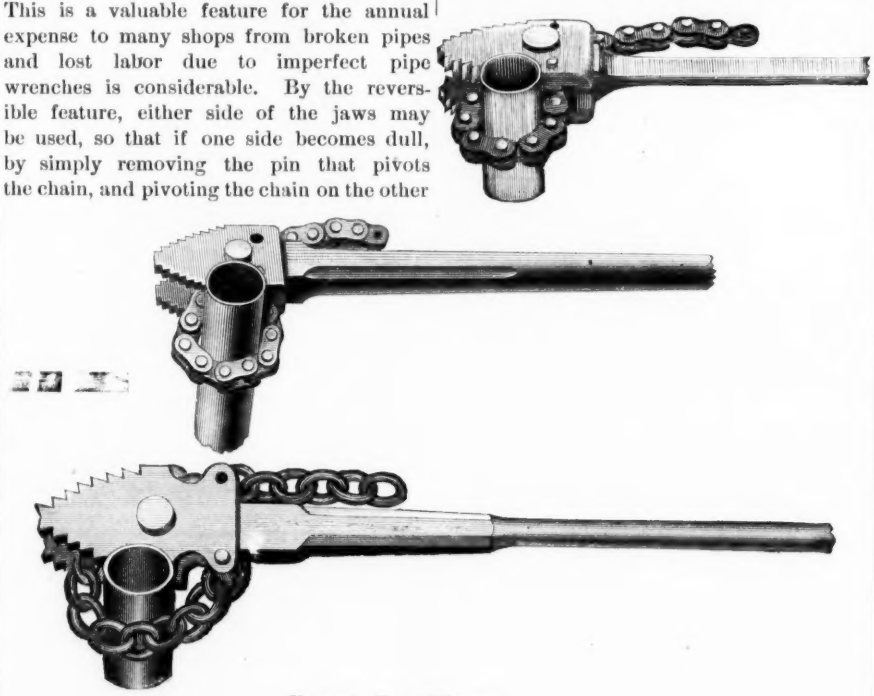
The machine shops belonging to the Mexican Central Railroad, at the City of Mexico, are substantially built brick structures, designed after the best United States models. Most of the leading officials connected with the works, as well as managing the operating of the road, are Americans. F. W. Johnstone is superintendent of motive power and machinery; M. S. McCoy is secretary; R. P. Simpson is master mechanic, and the master car builder is J. H. O'Brien. The locomotives are housed in a commodious roundhouse of fourteen stalls, which is in charge of H. Fitzsimmons. A well-arranged machine shop is furnished with the most approved tools, and gives work to thirty men, who are looked after by T. W. Schew. In the blacksmith shop there are twelve forges and thirty men, who are under charge of C. W. Lukens.

Brock's Pipe Wrench.

The engravings represent this wrench in different sizes, for pipe from $\frac{1}{8}''$ up to 20″. It consists of two steel side pieces or jaws, each formed with teeth upon both edges. Between these pieces the handle is fitted in milled recesses, so that in use no strain comes on the bolt that holds the jaws and handle together. These side pieces are made of dropped steel forgings, hardened to a saw temper, so as to be sharpened with a file when it becomes necessary.

In the sizes used for ordinary diameters of pipes the binding chain is made of flat steel links, so that all the parts, including the handle, are of steel. One end of this chain is held by a pin through the jaws, while the other end is slipped into a recess in the jaws and handle, being lengthened or shortened to correspond to the diameter of pipe on which it is desired to be used, the work of changing from one size to another being almost instantly performed.

The recess into which the chain fits is of such shape that the chain is not likely to drop out or "unhitch" while being used. In use it will be seen that the pressure of the teeth is in a direction tangent to the circumference of the pipe, and it is claimed that this, with the encircling grip of the chain, makes it impossible to crush even very thin pipe. This is a valuable feature for the annual expense to many shops from broken pipes and lost labor due to imperfect pipe wrenches is considerable. By the reversible feature, either side of the jaws may be used, so that if one side becomes dull, by simply removing the pin that pivots the chain, and pivoting the chain on the other side, a new set of teeth is brought into use, the dull set being sharpened at any convenient time. In the large sizes the chain is standard round link.



BROCK'S PIPE WRENCH.

The parts of these wrenches being interchangeable, repairs are easily made, and being of steel, the wrenches are light and convenient. The following, from the report of chief engineers Isherwood, Zetter and Hunt to the Bureau of Steam Engineering, Navy Department, explains to some extent the working of these wrenches:

"* * * Conformably with the orders of the Bureau, we have carefully examined and experimented with Brock's patent chain wrench, submitted by Mr. Charles P. Butler, * * * and have the honor to report that:

"The tool in question is for the purpose of firmly gripping any round surface, such as pipe, etc., by means of friction, with such force as will enable the surface to be turned against great resistance without slipping. This is accomplished by means of a jointed chain, instead of the usual 'pipe tongs' pinch, which chain is so arranged as to securely hold the cylindrical surface somewhat after the manner of a 'Spanish windlass.'

"The action of the wrench when experimented with was quite satisfactory, never slipping with the application of even the greatest force, and being readily and easily applied to the object.

"This tool is extremely well designed, it is well made of the best steel, is handy, convenient, and serviceable, and is the best for its purpose of which we have knowledge; for pipe work it is greatly superior to the usual pipe tongs."

The *Bear* and *Thetis* of the Greely relief fleet were supplied with these wrenches. The manufacturer's agent for these wrenches is Charles P. Butler, 223 and 225 Water Street, Brooklyn, N. Y.

Louisville and Nashville Railroad Shops at Louisville.

Writing to us about the Louisville & Nashville Railroad shops at Louisville, Frank C. Smith says:

I saw a very neat and effective application of the flexible shaft here, by which emery rollers of from $\frac{3}{4}''$ to $1\frac{1}{2}''$ diameter and 10″ long were driven at 3,000 turns per minute. Loose handles at each end allowed this effective tool to be used on any flat surface—such as side and main rods, link slots, etc. Its small diameter allowed of any spot being touched, while its adaptability, flexibility, and handiness made it as effective as the work of innumerable files, with the freedom of one. The four consolidated engines designed by Reuben Wells, S. M. P., and built at their shops with Belpair boilers are giving remarkable satisfaction. A neat stroke of economy was shown me by Mr. Leeds—many engines on the Southern divisions are wood burners, which are being changed for coal. The copper flues from the wood burners as they come in are carefully stowed away for future injector pipes, etc.. These flues are 2″ diameter, and as a pipe of $1\frac{1}{4}''$ to $1\frac{3}{4}''$ is required, the flues would be useless, but for a 'wire drawing' process, Mr. Leeds has invented by which he gets any size desired. The end of the flue is bent in, so as to leave the opening about $\frac{3}{4}$. A bolt is dropped through this hole, head inside and nut outside. A rope attached to a 'snatch block' is tied to the bolt just back of the nut, when the flue goes through a $1\frac{7}{8}''$ hole in a steel plate next a $1\frac{3}{4}$, etc. The force is of course supplied through by the snatch block.

Mr. Leeds thinks the first steel side rods were used on the New York, New Haven and Hartford Railroad twenty-four years ago. Previous to that, round iron rods were used which broke as speed and loads increased. The size of rods was increased which aggravated the trouble. Then Mr. Kettendorf (present M. M.) adopted a light crucible cast steel rod $3\frac{1}{2}''\times1\frac{5}{16}''$ which prevented all further trouble. Mr. Leeds ran the first of the engines having these steel rods on, and that when slipping the rods seemed to writhe and twist like a snake, but were always found all right, and are, he thinks, in use to-day.

Air-Pump Regulator.

Clement E. Stretton, C. E., describes in the *English Mechanic* an air-pump regulator used in connection with the Westinghouse brake on British railways, which we have never seen here. Since it gives such satisfaction there, we do not see any reason why it should not be equally valuable on American railroads. The writer says: "The use of a governor for automatically regulating the pressure obtained by the Westinghouse air-pump is strongly recommended; for, besides preventing drivers having too high pressure, it saves steam, since the pump never makes an unnecessary stroke. The pump continues to work and increases the pressure of air in the main reservoir until it exceeds that which the spring of the governor is adjusted to; any excess of this pressure at once acts on the under side of a diaphragm, which lifts a valve, by means of which the steam supply is automatically cut off, and consequently the pump stops working. Upon a reduction of pressure the pump again starts, and thus always maintains the required amount. The arrangement is very simple, and is largely employed upon the Northeastern Railway, also in France and America."

From the Glasgow *Engineer* we learn particulars of trials that have recently been made in a Scotch colliery with the Harrison coal mining machine, an American invention. The machine is worked with compressed air, and did its work very satisfactorily on extremely hard coal seams that are difficult to work by picking. An incidental advantage found by the use of this machine was that the air exhausted from the cylinder improved the ventilation of the mine by inducing air circulation.

George H. Corliss, Providence, R. I., has received a patent on an engine cross-head with adjustable gibs. The cross-head tapers on the line of the guides and the gibs are made to fit this taper. By turning an adjusting screw the gib is drawn on the cross-head increasing the vertical diameter and so taking up any lost motion.

Early Engineering Reminiscences.

BY AN OLD ENGINEER.

FIRST PAPER.

When requested to jot down some reminiscences of the mechanic arts as far back as my own recollection went, and the difficulties encountered and overcome by mechanical and civil engineers, the task seemed easy to one who, it might almost be said, was born in the workshop. But when I looked back over the field to the time when my school days' associates were J. E. Thompson, Wm. Miller, J. C. Trautwine, Elwood Morris, J. W. Roberts, Wm. Milnor Roberts, Hufnagle, Dahlgren and others, who became eminent in their lines, and at the works they accomplished, and considered that the early teachers or advance guard in civil engineering were borrowed, as I might call it, from the topographical department of the U. S. Army, to initiate the first important harbor and canal works, and afterwards some of our earliest railroads; when at that time I could count on my fingers the whole available array of talent in that direction, that now number by thousands of competent men in both branches of the profession, the vast works that have been accomplished within the lifetime and recollection of one man, when looked back on, become almost appalling and beyond the power of mind to grasp. It becomes difficult to select from the extended picture, and condense into a reasonable space, such scraps as will interest the engineer of the present day; but whatever throws light on the antecedents that have led to the present high state of the mechanic arts, must be interesting to all thinking minds.

I remember the time when every boy must possess an original Barlow knife. At that time the same may be said of the Southern tobacco grower and cotton planter. They must have screws for their presses, and these screws must be of John White's make; no others would be accepted if these could be obtained, not even imported screws.

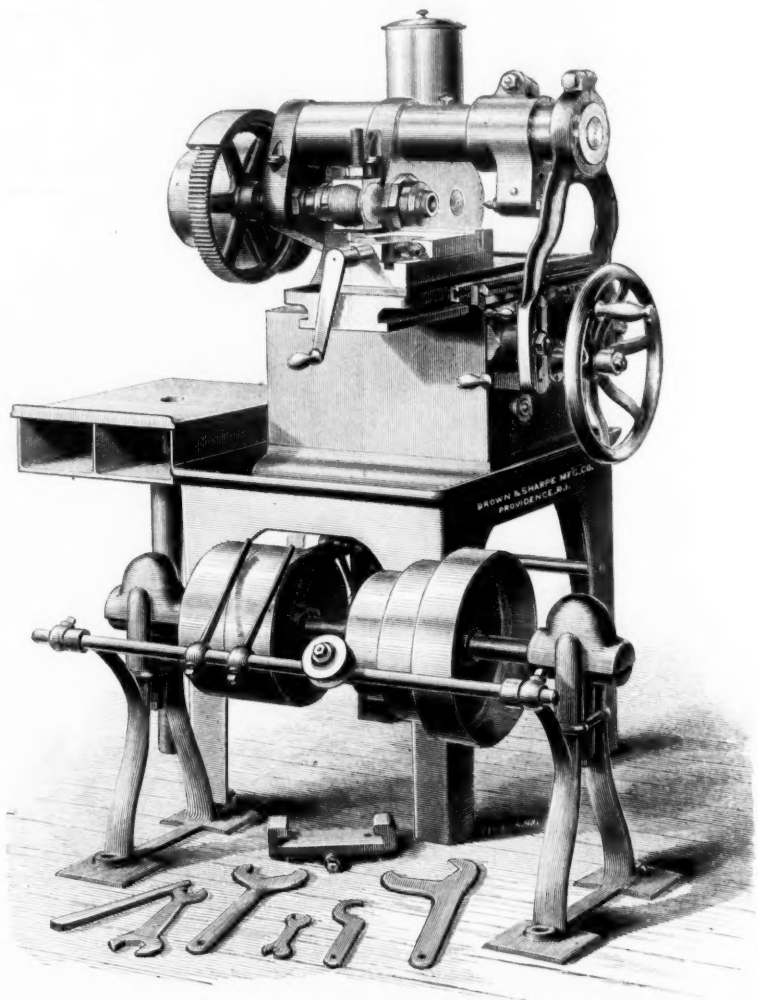
I now propose to describe, as well as I can, without the help of drawings, White's mode of operating, and the tools he used in making his screws. I can fix the date at 1816, from the fact that I watched with great interest his entire process at various times during my summer vacations of 1816 and 1817. Engine lathes with gearing to cut screws of various pitches were unknown at

that time. The screws he cut for cotton-presses and paper mills were of two kinds—one called the lantern head, a large globe head with holes through it, crossing at right angles for wooden press levers; the other with a square body slightly tapered to receive a trundle or lantern wheel of four bars, between which and the body of the screw the press lever was thrust; this latter was at that time coming into use, being less liable to break than the lantern head. The large diameter of the trundle enabled the pressman to use it as a hand wheel to run the screw down and give considerable pressure before using the lever and windlass. This class of press screws were made of cast iron, and rarely exceeded 6 inches diameter. They were cast at the foundry of Rush & Muhlenburg, Philadelphia, and turned ready for cutting the screw thread on a lathe got up by Cadwalader and Oliver Evans. This lathe was the nearest approach to our present engine lathe that I can recollect in Philadelphia at that time. It was a wooden shear lathe with cast-iron slides for the poppet head and tool-carrying rest, which rest was moved by hand wheel with crank-handle operating a pinion attached to the rest and working into a fixed cog-rack on the front shear.

Screws for tobacco and other small presses were of wrought iron and varied from about $2\frac{3}{4}$ in. to 4 in. diameter, and in every case made of piled charcoal iron, nine square bars being used to each pile; the object being to have a solid center bar. These pile rods of hammered iron of the required size were made at some one or other of the Pennsylvania charcoal forges. The piles were heated in a hollow fire of imported bituminous coal, at that time known as Liverpool coal, or an open hearth by a blast from a couple of wooden tubs about 4 feet diameter, their pistons alternating by a wooden walking beam, worked through a connecting rod by a crank on the end of the shaft of a breast water-wheel. There was a third tub with weighted piston to regulate the blast.

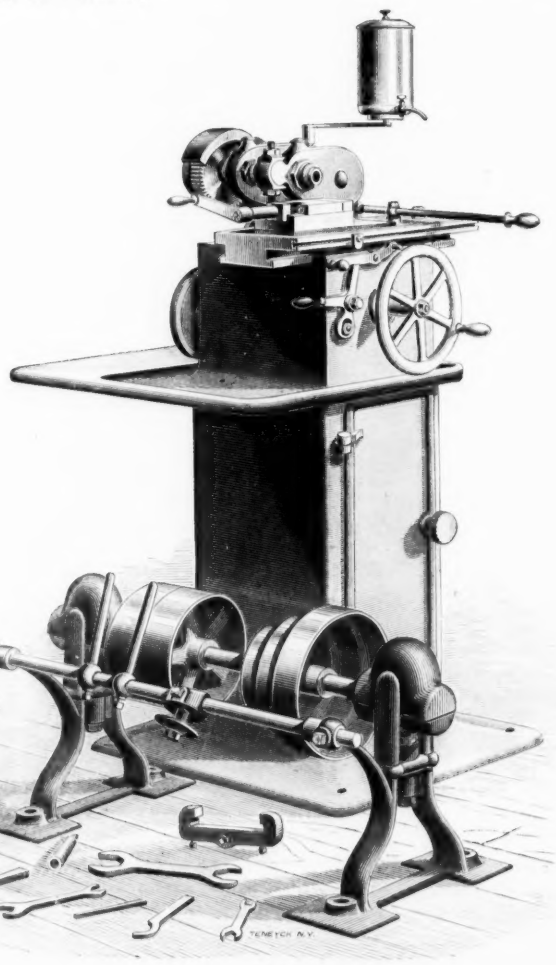
The forging was done under a couple of trip hammers, one for roughing, the other for swedging, driven by an undershot waterwheel, with tappet wheels on its shaft, regulated in their diameters and number of tappets so as to give twice the number of blows to the swedging hammer. The heads of the screws with lever holes at right angles and one above the other were shaped and finished on an ordinary anvil, with hand hammer and sledges. On the end of the screw bolt was forged a square tit not over half an inch long and of such a size as to come within the diameter of the bottom of the screw-thread when cut; the object of this tit will be explained further on.

The turning and screw-cutting lathes were of the most primitive construction. The bed or shears were two white oak timbers about 12″ or 14″ square, about 6″ apart, securely bolted to stone foundations. The lathe head was two pieces of timber the same size as the shears boxed into and crossing them, with a space of about a foot between them; into these the boxes that carried the mandrel were let, the overhanging center-carrying end of the mandrel was square on which the face-plate, or rather cross, was keyed; the entire end thrust was taken by the boxes by collars on the journals, the back end of the mandrel was also square and overhung sufficiently to carry a spur wheel about 4′ diameter, with 5″ or 6″ face with wooden cogs in which a trundle pinion worked as the driver; part of the pinion shaft was square, on which part slid a ratchet clutch, which fastened by a corresponding ratchet on the iron hub of a loose, deeply grooved wooden pulley, driven by a twisted rope belt made of raw hide; the ratchet clutch was so arranged as to be shoved into gear or disengaged by a foot treadle in front of the lathe shears, giving the operator instant command both in starting and stopping.

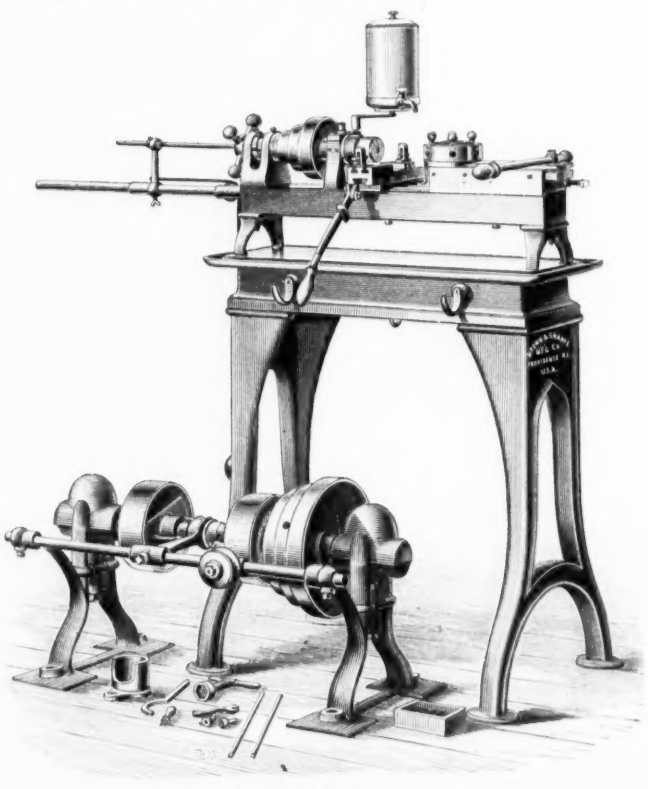


PLAIN MILLING MACHINE.

The back or poppet head was similar to the main head only differing in its timbers not being so heavy and being set closer together, and on their under sides connected by a piece of wood fitting and projecting into the space between the shears, to act as a guide for the back head; the mandrel was square let into and screwed on its angle to the head blocks, the end of this back mandrel carrying the center overhung the blocks about 3 inches and was accurately turned to a collar, which, besides its especial object, prevented the mandrel sliding back on the head blocks. There was no arrangement to move this mandrel forwards or back; the head was clamped to the shears in the usual way, and the center held to its work by wooden wedges driven between the head block and a piece of scantling that lay across the shears, held in its place by iron pins in holes in the top of the shears. There were rows of these auger holes about $1\frac{1}{2}$″ diameter and 6″ or 8″ apart. The tool rest or rather rests, for they were the lengths suited to the bolts to be turned and screws to be cut, were flat bars of wrought iron secured to wooden rests; the only way to regulate the height of these long rests was by the thickness of the wooden supports. Close to the edge next the work of these wrought iron rest bars, was a slight groove. From end to end in this groove was rolled a button and hand tool with so long a handle that the operator could rest it on his shoulder. I was often astonished at seeing the long curled shaving turned off in this primitive manner, and at the accuracy of the bolt turned, when tested by straight-edge and calipers.



SMALL PLAIN MILLING MACHINE.



SCREW MACHINE.

Improved Machine Tools.

The engravings on this page represent three of the machine tools made by the Brown & Sharpe Manufacturing Company, Providence, R. I., as recently improved. The plain milling machine is designed for use on ordinary plain work. The spindle, which runs in anti-friction boxes provided with adjustment for wear, is raised or lowered by means of a screw and nuts, and is adjusted horizontally by nuts on the front bearing. The table is automatically fed for a distance of eighteen inches, the feed being disconnected at any desired point by an adjustable stop. The total length of table is 28 inches; width $9\frac{1}{2}$ inches. The height of center, at its lowest point above table is $2\frac{3}{8}$ inches, and at its highest point 6 inches. The vise jaws are 6 inches long and $1\frac{5}{16}$ inches deep.

The small, plain milling machine has a table, which may be operated either by the automatic feed or by means of the hand lever shown. The total length of the table of this machine is 20 inches; width $7\frac{3}{4}$ inches, with automatic feed of 9 inches. The height of center above table is $1\frac{1}{2}$ inches, and $3\frac{3}{4}$ inches at its lowest and highest point, respectively. The vise jaws are $3\frac{1}{2}$ inches long and $\frac{3}{4}$ inch deep. Both machines have an attached stand or table for holding work and tools. Countershaft and hangers, with iron cone and all overhead work complete; also necessary wrenches accompany either machine.

The screw machine represents one of several sizes made by the firm. These machines have a device for instantly opening and closing the jaws that hold the wire or rod from which the screws are made, without stopping the machine, and are intended in every respect for doing work very rapidly.

A Large Casting.

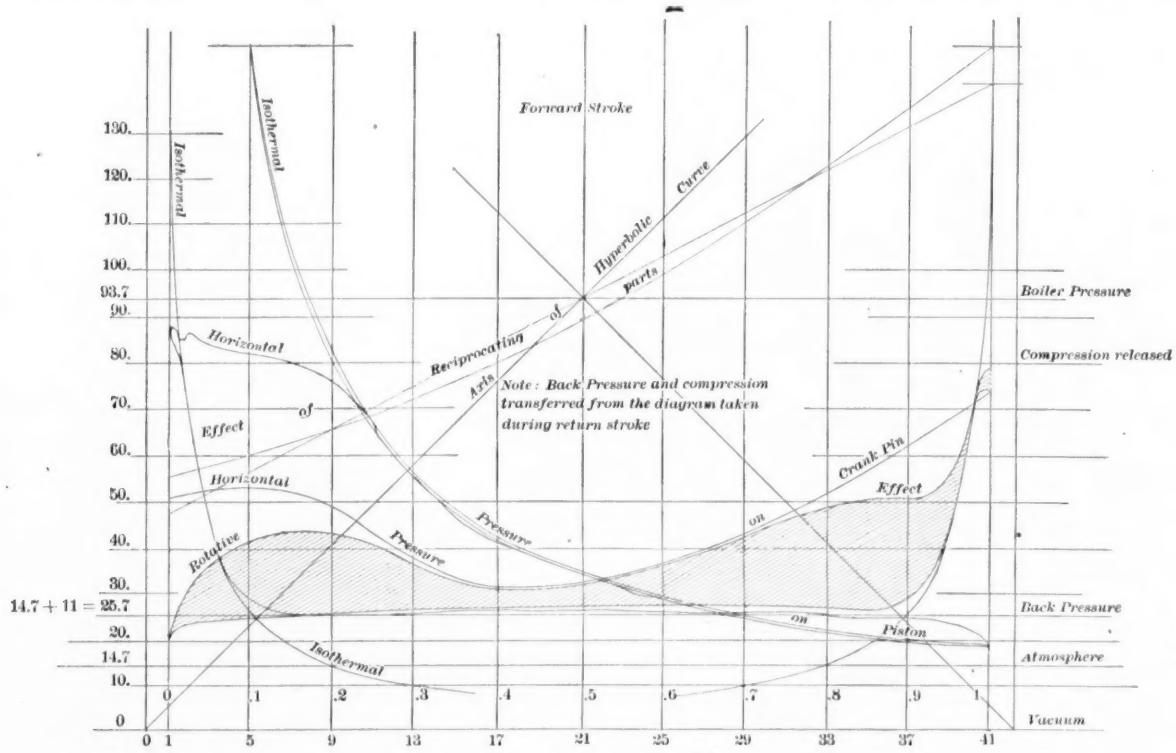
A large job in the way of casting was done very quickly a few days ago at the Philadelphia and Reading Iron Shops, Pottsville, where Mr. E. F. C. Davis is superintendent. The casting was half of a huge drum intended for one of the company's mines. When completed, the whole drum will be fourteen feet long, nineteen feet in diameter at the center and twelve and one-half feet at the ends. Each completed half weighs 32,000 pounds, but 37,000 pounds of molten iron was used in the casting, the extra iron going for stays and wastage. It took eight men five weeks to prepare the mould for this casting. After all the preparations were completed, it required only one minute and ten seconds to pour the whole 37,000 pounds of iron. Of this mass, an immense 15,000-pound ladlefull had to be taken from the lower shops that stand some distance away from the building where the casting was done.

LETTERS FROM PRACTICAL MEN.

Diagrams Showing the Inertia of the Reciprocating Parts of the Steam Engine.

Editor American Machinist:

The clever instrument described by your correspondent, Mr. Williams, in your issue for May 10 inst., called quite appropriately an "inertia instrument," interests me not a little. It reminds me of Mr. Brown's pretty subsidiary indicator for showing the inequalities of tension on the cord of the paper cylinder in the steam engine indicator. It would be interesting and instructive to compare the indications of Mr. Williams' inertia instrument with the theoretical curve, which is easily traced when the weight of all the reciprocating parts, the length of the connecting rod and of the crank, and the velocity in revolutions per minute are known.



The relative length of the crank and connecting rod always enters into the calculation, except when rough approximation only is desired, or when working upon *mean* diagrams, that is, upon diagrams representing a mean of actual diagrams from each end of the cylinder.

The accompanying cards, taken October 13, 1879, at 5:39 P. M., soon before closing work, from a Buckeye engine at the Merrimack Mills, Lowell, by Mr. Lyman, were worked up by me soon after they were taken, and have been carried in my pocket-book ever since. The calculations (in part) are on the back of the "out end" card. On each card the *mean* effect of the inertia of reciprocating parts is represented by a straight, oblique line, and the *true* effect by curved lines, concave upward on the crank end card, and convex upward on the out end. The areas shaded by fine hatching lines show the actual rotative effect throughout each stroke; and show that rather more work is done during the last quadrant than during the first quadrant, notwithstanding the light load, early cut-off, great back pressure (11.0 lbs. per square inch above atmosphere), and the reduction of pressure by expansion, about 8 lbs. below the back pressure. I think the diagrams are so fully marked as to explain themselves.

The "rotative effect" is the tangential component of the horizontal pressure on the crank-pin, and is, of course, the pressure exerted on the crank-pin in a direction at right angles to the crank, *i. e.*, tangential to the path of the crank-pin. All that Mr. Williams says about lost motion, springing of parts, etc., is quite correct. So, too, the diameter of the cylinder is increased by the steam pressure, and the stroke is affected by the elongation and compression of piston rod, connecting rod, bed plate, and cylinder.

Boston, Mass. J. C. HOADLEY.

DATA OF TWO INDICATOR CARDS

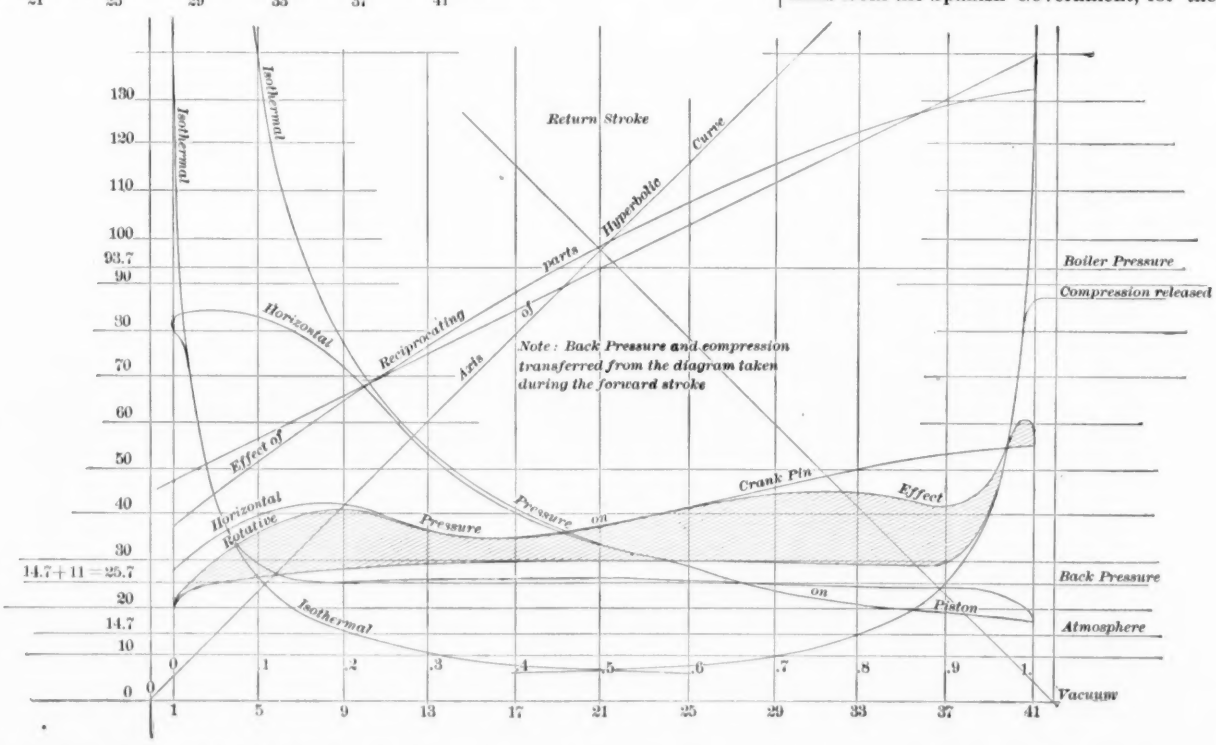
taken at Merrimac Print Works, Lowell, Mass., October 13, 1879, at 5:39 P. M.: Engine, right-hand 3-foot stroke by 24" bore, non-condensing; steam, per gauge, 79 lbs.; back pressure, per gauge, 11 lbs.; revolutions, 159 per minute; scale, 40; diameter of piston rod, 3½"; weight of reciprocating parts, 1,665 lbs.

A Practical Question.

Editor American Machinist:

The undersigned have a friendly discussion in regard to what effect, if any, will be produced upon one or both of a pair of steam boilers, under the conditions named below, and wish to refer same to such of your readers as are stationary engineers, and have had charge of connected boilers, and can therefore speak from experience and not from theory.

The conditions are these: Given, two tubular boilers, 54 inches in diameter, 12 feet long,



53 3-inch tubes, shells $\frac{5}{16}$ths and heads $\frac{7}{16}$ths inch thick, located side by side, 12 inch brick wall between, domes connected by 4-inch pipe, with globe-valve therein, *closed*, feed-water pipe 1¾ inch, passing through steam space, and its discharge end turned down and terminating below water-line, and having two check valves (one each side of pipe leading from pump), two gauges of water in each boiler, steam 95 lbs. in one boiler and a brisk fire, steam in other boiler 30 lbs. and a somewhat slower but brisk fire, safety valves set to blow off at 110 lbs.

Would the effect be disastrous, or in anywise attended with danger, if the globe-valve in connecting pipe were opened?

D. H. BALDWIN,
Foreman Gouv. Machine Co.
J. S. CORBIN,
Supt. St. Lawrence Manufacturing Co.

Large Engines and Small Boilers.

Editor American Machinist:

Your correspondent, A. Brunson, (May 21) is somewhat at sea on steam pipes. He seems to think that a small steam pipe will supply an engine as well as a large one. So it will if it is large enough to take all the steam the boiler will supply. His engine worked as well, he says, with the throttle opened one-half turn as it did when full open. This proves that at one-half turn the valve opening was sufficient to pass all the steam the boiler would supply, therefore the engine was too large for the boiler. To illustrate, suppose he undertakes to run a 20-horse-power engine with a 10 horse-power boiler. It will be of no use to connect with the size pipe the engine calls for. It will cost less and be just as well otherwise to connect with the size pipe the boiler calls for. Nothing is more wasteful than the combination of an engine too large, and a boiler too small. There *is* no "use of such large steam pipes," unless there is steam to fill them.

PETER GIBBONS.

Steam Pipe Diameter.

Editor American Machinist:

In your issue of May 24th, A. Brunson says of an engine he had charge of that it did as well with the throttle nearly closed, and asks, "What is the use of so large a steam pipe?" Will Mr. Brunson tell us whether the engine was full stroke or a cut-off?

On the same line of reasoning, when using a one-inch nozzle for fire purposes, why use a two and one-half inch hose? I think a very fair explanation of the use of small pipes is given on page 6, with the diagrams shown by Mr. Hemenway.

With a boiler pressure of sixty pounds he gets an initial pressure of thirty-five in one case; and in the other boiler pressure sixty-two, and initial pressure forty-two.

In our best class of cut-off engines I hardly think Mr. Brunson would be able to do the work with the "wheel open one-half turn" and keep speed regular, or do the full amount of work with the same economy.

Waterbury, Conn. W. E. CRANE.

New York to Chicago in Seventeen Hours.

At the meeting of the American Society of Mechanical Engineers, held at Pittsburgh last week, Mr. W. B. Le Van read a paper with the above title. He believes that the Pennsylvania Railroad Company, with their present style of locomotives, could make the run of 908 miles between New York and Chicago in seventeen hours if they will adopt safety gates in all the cities, so that trains may be run through towns without reduction of speed. Mr. Le Van gives some details of how this run can be made, furnishing the necessary time-table. He would make seven stops for change of engines, and he calculates that the 908 miles can be run in 1,000 minutes, including the delay in changing engines. There are 34 grade crossings on the way, and he allows 20 minutes for loss of time by reducing speed at all these points. As trains on the Bound Brook route have been known to pass over a mile in 45 seconds, Mr. Le Van does not see anything to prevent trains being run to Chicago on his time schedule. He thinks that in ordinary high-speed locomotives there is a loss of over 30 per cent. of power through using the link motion, and he proposes to save this by using a separate cut-off valve, similar to that applied by Mr. Stevens, of the Central Pacific Railroad, to some of his locomotives.

Very extensive steel works are shortly to be started in Bilbao, Spain, by a Spanish company, which has obtained large concessions from the Spanish Government, for the manufacture of rails and other material. The machinery is being made in England. Converters are of eight tons capacity. It is intended that the works shall commence about the first of next year. They will be the first works of the kind which have been started in Bilbao, the ore found there having hitherto been exported to England, Germany, Belgium, and France. All the coal required for them will go from England.

The Thetis, of the Greeley search expedition, was disabled for twenty hours the second day out of New York by the breaking of a connecting rod of the circulating pump. The fact that the rod was successfully welded speaks better for the mechanical ability on board than the fact that notwithstanding

there was known to be a spare rod some where it could not be found, does for the care with which the spare parts of machinery were stored.

Barthel Lubricator Cups.

We here illustrate two lubricator cups designed specially for the lubricating compounds manufactured under the Reisert, Stauffer & Barthel patents. All these lubricators are pasty substances made by special chemical treatment of oil, and the cups that hold the compound are made so that the lubricant can be pressed out of the cup into the bearing. In every case a disk is used to press the lubricator downward, thereby forcing it into the oilways of the journal cover. In the Reisert cup shown the disk that rests on the lubricant carries a hollow tube which projects from the top of the cup. By placing shot, or any other heavy substance, in this tube the flow of the lubricant can be regulated. The compound used is said to give remarkably good lubricating service, and a small supply to a bearing keeps it running cool. The lubricant in the Stauffer cup is forced out by turning the top of the cup. Cups of this form are made to apply lubricants to shafting and all kinds of bearings, whatever position they may occupy among machinery. The lubricant is conveyed through small pipes, and it is forced through the pipes by the pressure put upon the contents of the cup when the top is turned, thereby depressing the disk. R. A. Goodchild, 111 Liberty Street, New York, is agent for these cups and lubricants.

The proprietor of the *Railway Review*, who has been traveling in Mexico, does not write favorable impressions respecting the Mexicans who generally loiter round the railroad station. He says that the principal possessions of a great many of these men consist of a pistol and a sombrero.

American Association for the Advancement of Science.

The American Association for the Advancement of Science is making an active effort to place its mechanical section on a footing that will be creditable to the country when the members of the British Association meet with it at Philadelphia in September. The association, which is represented by Prof. Thurston, the president, and Prof. Webb, the secretary, has sent out a circular inviting gentlemen interested in the advancement of mechanical science to attend the meeting at Philadelphia, to join the association, and to take an active part in the proceedings. The meeting of next September will have unusual attractions, and it is expected that a large attendance will be secured. The Electrical Exhibition will be open in Philadelphia during the time of the meeting.

The introduction of steel ties must have been silently going on with great rapidity if we may judge from a paragraph in *Iron*, which says in a review of "the manufacture of steel in America," that "steel has also been employed for the manufacture of sleepers. It is calculated that about 600,000,000 steel sleepers are laid down on the roads of the United States, each one containing from 60 to 80 pounds of steel." Considering that there are less than two-thirds of this number of wooden ties in use, the "recent publication" from which the information is said to be derived must certainly have suffered a "sea-change into something rich and strange" while crossing the Atlantic. The day may come when there will be millions of steel ties in America, but at present we do not know of one.—*Railroad Gazette*.

A Preacher on Hot Boxes.

We heard a preacher in a fashionable "uptown" church last Sunday expounding the advantages to mankind of keeping the Sabbath. As an illustration of how all nature, inanimate as well as animate, required cessation from labor, he said: "Even in traveling with railroad trains, we find that stops have to be made at certain distances to let the axle boxes get time to cool. The labor of running makes these boxes get hot, and, if their necessity for rest was ignored, they would get red-hot and burn up the train. But the train men understand the case, and the train is stopped for a time, and, while passengers go out and refresh themselves, the boxes are getting refreshed by rest. They cool down in a few minutes, and then the train can proceed in safety!"

Pittsburgh Meeting of the American Society of Mechanical Engineers.

The society began their sessions at Pittsburgh, Tuesday, May 20, and continued them according to programme, President Sweet presiding.

The first meeting was, by invitation, held jointly with the Engineers' Society of Western Pennsylvania, at which a report of a special committee of that society on natural gas for industrial purposes was presented, and jointly discussed by the members of both societies. This gas, as shown by the report, which is conducted in pipes from wells at considerable distances from Pittsburgh, is used in iron and steel-making, under boilers, for household and for various other purposes. Some of the points brought out in the report were—that a much greater percentage of the calorific effect can be utilized than in the case of coal, while the absence of smoke, dirt and cinders is an additional advantage of its use. In comparative tests under boilers, while with coal 9 lbs. of water was evaporated per pound of coal, with an efficiency of 60.9 per cent., with natural gas 83 + per cent. of the value of the fuel was utilized.

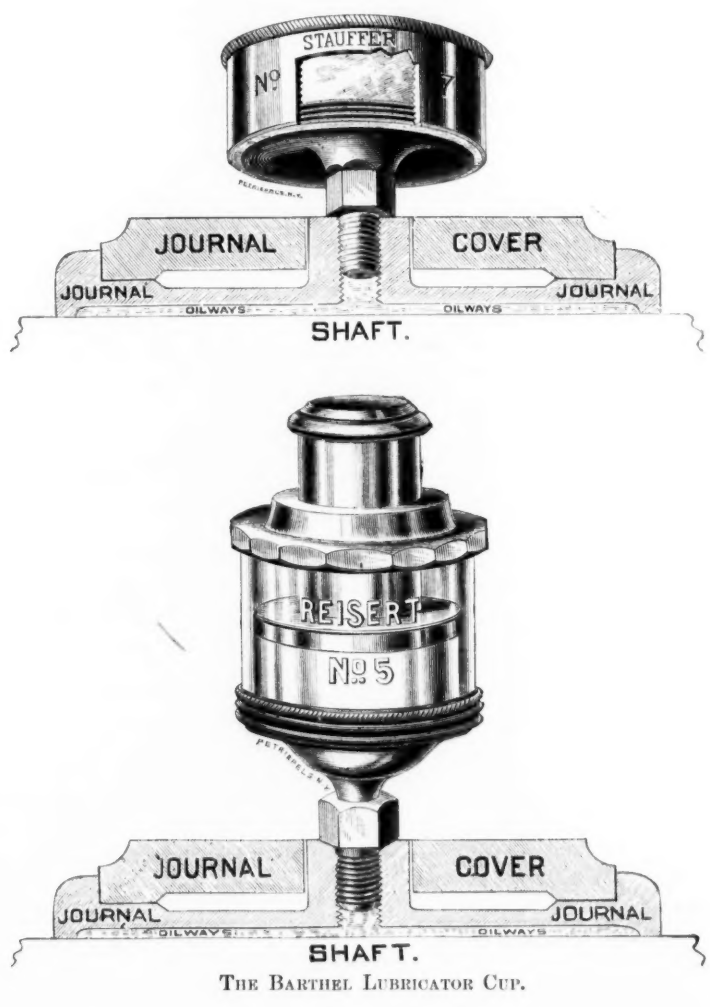
For many industrial purposes for which it was used, it was claimed that the means of using it were wasteful, and not much more than one-third as good results were obtained as might be. It was conceded that the danger of explosions were rather greater than with coal gas, since explosive mixtures could be formed with greater variations in the quantity of air than with coal gas.

The temperature of the gas at the wells is about 45°, and this keeps the temperature of the pipes so nearly constant that in mains several miles in length no allowance for expansion is required, the pipes being laid below the point to which frost penetrates.

Pittsburgh, it was said, could obtain this gas from several "belts," it being found there at a depth of something more than 1,000 feet below the surface. It was said better steel, iron and glass could be made by its use than by the use of other fuel. It is about 96 per cent. marsh gas, and about half as heavy as air. At present it would seem from the report that its use for manufacturing purposes was not so economical as the use of other fuels.

In the discussion the fact was sustained that a boiler of given dimensions could be made to generate much more steam when this gas was used as fuel than when coal was used; also that very little vent was required for the escape of gases. No combustion chamber was required, the gas being burned the whole length of the boiler and only a few inches—say 8 inches—from the shell, the flame impinging directly against the shell. It was conceded that hard firing in this way was somewhat destructive to the boiler. It was said that 20 lbs. of water could be evaporated in this way per pound of gas, but that when the gas was used with combustion chamber inferior results were obtained. If the total calorific effect of the fuel was realized 26 lbs. of water could be evaporated. One speaker said that with coal at five cents per bushel (76 lbs.) he had found the value of gas to be $7\frac{8}{10}$ cents per 1,000 feet, at a pressure about equal to that at which coal gas is used. It was brought out that in some parts of Pennsylvania natural gas had been used for generating steam twenty years ago; also that it had been used directly in the cylinders of engines under the pressure at which it flowed from the wells, 100 lbs. per square inch and upwards. It was suggested that the pressure might first be utilized in the cylinders of steam engines, and then the exhausted gas used for heating purposes, and stated in reply that it had been so used, but its use in this way was not favorabiy considered.

Altogether the report and the discussion would tend to confirm the opinion that while there might be a large economical future for natural gas, the length of time the supply would last was somewhat uncertain, and that economy in its use had not yet been properly considered. Some of the strongest points were made in favor of its use for domestic purposes.



THE BARTHEL LUBRICATOR CUP.

Mechanical Engineer's Meeting.

Our limited space prevents us from giving an extended notice this week of the transactions of the Society of Mechanical Engineers at Pittsburgh, May 20th to 23rd. The meeting was in every respect interesting and profitable. The membership was increased by 113 members, 5 associates and 3 juniors. The papers read were above the average in value, and the discussions elicited indicated that the members present were actively interested in the subjects brought forward.

Henry Ward Beecher says the cause of the recent bank troubles and consequent panic in Wall street was overtrading. We thought it was overstealing.

The classification of articles for exhibition, at the World's Fair in New Orleans, is not as thorough as it might be. For instance, "machines for barrels, casks, and kegs," do not usually come under the head of machine tools. Neither do machines for cutting cork.

Consumption of Fuel in Locomotives.

At the last meeting of the British Society of Mechanical Engineers a most valuable paper was read on the above subject, the author being M. Georges Marie, Chief Engineer of the Paris and Lyons Railway in France. M. Marie's position gave him excellent opportunities for experimenting with the locomotive. For years he had been familiar with the progress of improvement in stationary and marine engines, and he became desirous of aiding the locomotive to join in the march of progress. Before making any change in the familiar form of the locomotive, he determined, to ascertain with exactness the value of its performance in comparison with what are recognized as the best forms of engines. As the ordinary practice of recording the performance of a locomotive according to train miles furnished an indifferent basis of estimation of the actual work done, M. Marie reduced the performance of his locomotive to horse-power. In his experiments he was assisted by two well known scientists.

The conclusions arrived at were that the locomotive, which was a good one well handled, did its work with a fuel consumption of 3.27 pounds per effective horse-power or 2.88 pounds per indicated horse-power. The ratio of water evaporated to the pound of fuel was 8.88. The fuel used was a patent compound of less calorific value than the ordinary run of good American coal. From these results it will be perceived that a first-class locomotive in skilful hands is not so imperfect as many engineers believe it to be. M. Marie maintains that the simplicity of the locomotive is its most valuable feature and contributes in an eminent degree to its success as a high speed engine. The high speed is favorable to economy of fuel because it diminishes the leakage of steam and the condensation of steam during admission.

Another French engineer proved by accurate experiments that express train locomotives were more economical than freight engines, he having got as high a duty as one indicated horse-power to 2.48 pounds coal. This, of course, is testimony in favor of high piston speed.

The annual catalogue of the Stevens' Institute of Technology for 1884–5 indicates that the institution has valuable and interesting work laid out for the coming year. The exercises on experimental mechanics strike us as particularly important. Under this head is grouped strength of materials, valve gearing, boiler testing, engine tests, pump *vs.* injector, flow of fluids, measurement of power, and standardization of instruments. We hope that while the Institute has the students engaged on the pump *vs.* injector question that they will work to obtain some authoritive data showing with absolute certainty which is the most economical method of feeding boilers.

Locomotive Engine Running—The Valve Motion.

BY ANGUS SINCLAIR.

SETTING THE VALVES.

Most of intelligent machinists engaged on engine-work make it an object of ambition to learn to set valves, and the operation is mastered as soon as the opportunity offers. It has been a practice in numerous shops for those who have the work of valve-setting to do, to invest the operation with fictitious mystery, to patiently disseminate the belief that valve-setting is an exceedingly difficult matter. Cases sometimes arise where the squaring of an engine's valves is really an arduous task, requiring intimate familiarity with delicate methods of adjustment; but valve-setting, as it is usually practised in building establishments, in repairing shops, and in round-houses is merely a matter of plain measurement.

A man may be a first-class engineer without knowing how to set valves, and familiar acquaintance with the operation will not increase his ability in managing his engine when merely getting a train over the road on time is the consideration; but the method of valve-setting is so closely associated with an intelligent appreciation of the valve-motion's philosophy—that most of engineers who take an extended interest in their business wish to acquire the knowledge of how the valves are set.

BEST WAY TO LEARN VALVE-SETTING.

The best way to learn valve-setting is by taking part in the work. Whatever can be said in books on a subject of this kind provides but an indifferent substitute for going through the actual operations. But a man's ambition to learn may exceed his opportunities; so, for those who cannot get a gang boss to direct them into the art of valve-setting, this description will be made as plain as possible.

When an engine's valve motion is designed, the sizes of the different parts are arranged; and, if this business is done by a competent engineer, there will only be trifling changes necessary in valve-setting.

PRELIMINARY OPERATIONS.

Let us suppose the engine to be an ordinary eight-wheel locomotive, with cylinders 18x24 inches. Let us assume that the top and bottom rocker arms are straight, of equal length, and that the eccentric rods are connected to the link so as to be opposite the block in full gear. This will make the extreme travel of valve equal the eccentric's throw. We will now look round to see that everything connected with the motion is ready for valve-setting.

First, it is necessary to see that the wedges are properly set up to hold the driving boxes in about the same position they will occupy when the engine is at work.

CONNECTING ECCENTRIC RODS TO LINK.

In looking over the motion, it is well to note that the eccentric rods are properly connected—the forward eccentric rod with the top, the backward eccentric rod with the bottom of the link. When the crank-pin is

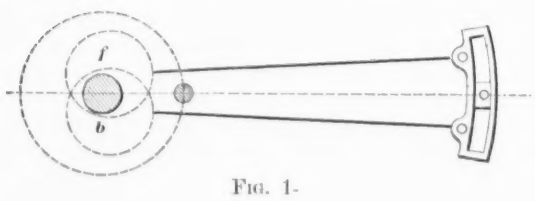


FIG. 1.

on the forward center, the eccentrics will occupy the position they appear in in Fig. 1, where the rods are open and nearly horizontal. The full part of both eccentrics are advanced towards the crank-pin, so that the centers of the eccentrics are advanced from a line perpendicular to the center line of motion, a horizontal distance equal to the lap and lead. When the crank-pin is on the back center, the eccentric centres will be behind the axle and the rods will be crossed as they are seen in Fig. 2. The reason why the rods must be crossed when the crank is in this position is, that the forward eccentric center is below the axle, and the backward eccentric center is above. As the forward eccentric rod maintains its connection with the top of the link and the backward eccentric rod is at the opposite end, crossing of the rods is inevitable. This fact is worth imprinting on the memory, for I have known of several cases where men got the rods up wrong by putting them open when the engine stood with the crank on the back center.

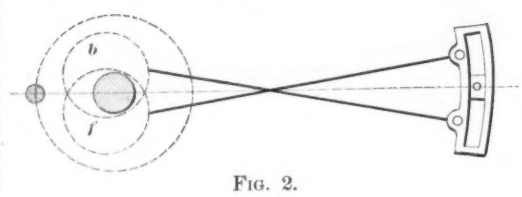


FIG. 2.

MARKING THE VALVE STEM.

In ordinary practice, valves are set with the steam chest cover down, and the position of the valve on the seat is identified by marks on the valve stem. Before the cover is put

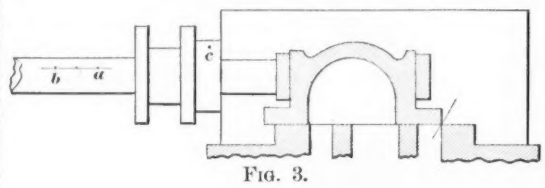


FIG. 3.

down the valve is placed as in Fig. 3, just beginning to open the forward steam port, a thin piece of tin being generally used to gauge the opening. When the valve stands in this position, a tram is extended from a center punch-mark, *c*, on the stuffing-box, straight along the valve stem as far as it will reach, and the point, here located at *a*, is marked. The valve is then moved forward till it begins to uncover the back port, when another measurement is made with the tram, which locates the point *b* on the valve stem. Whatever position the valve may stand on, it may now be identified by the tram. When the tram cuts the space half way between *a* and *b*, the valve stands in the middle of the seat.

Some machinists do not believe in tramming from the stuffing box as the point is liable to be moved in tightening down the steam chest cover. These generally measure from a point on the cylinder casting, but that practice has its drawbacks.

LENGTH OF THE VALVE ROD.

To prove the correct length of the valve rod, the rocker arm is set at right angles to the valve seat, which is its middle position. The valve must now stand on the middle of the seat, which will be indicated by the tram point reaching the dividing point between *a* and *b*. Should the valve not be right when the rocker is in its middle position, the rod must be altered to put it right.

ACCURACY ESSENTIAL IN LOCATING THE DEAD CENTER POINTS.

Before proceeding to set the valves a machinist cannot be too careful in locating the exact dead centers. Some men conclude that because there is little motion to the cross-head close to the end of the stroke, that a slight movement of the wheel to one side or the other is of little consequence, and makes no perceptible difference in the relative positions of piston and valve. This is a serious mistake, for, although the piston is moving slowly, the eccentric is proceeding at its ordinary speed and the valve is moving fast. The loose, quick method of finding dead centers followed occasionally are not conducive to exactness, and nothing but accuracy is permissible in valve-setting.

FINDING THE DEAD CENTERS.

The best way of finding the true center is by moving the cross-head a measured distance round its extreme travel, recording the extent of movement on the driving-wheel tire, whose motion is uniform; then bisecting the distance between the marks on the tire, when the dividing line will indicate the true center.

Thus: Turn the wheels forward till the cross-head reaches within one-half inch of its extreme travel, as shown in Fig. 4. From a point *a* on the guide block extend a tram

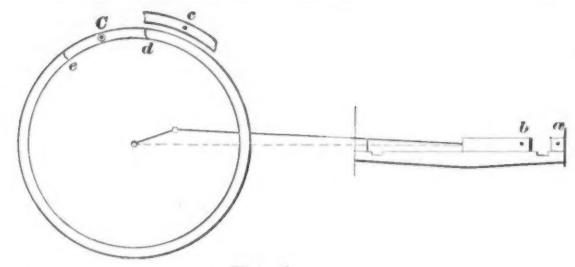


FIG. 4.

on the cross-head, and mark the extreme point reached *b*. Put a center punch mark *c* on the wheel cover, or other convenient fixed point, and from it extend a tram on the edge of the tire and scratch an arc *d*. Now, with tram in hand, watch the cross-head, and have the wheels moved forward slowly. When the cross-head passes the center and moves back till the tram extending from *a* will reach the point *b*, stop the motion. Again tram from the wheel cover point, and describe a second arc on the tire, which will be at *e*, now moved to the position which *d* occupied when the previous measurement was taken. With a pair of dividers bisect the distance between *d* and *e*. Mark the dividing point *C* with a center punch, and put a chalk ring round it. When the wheel stands so that the tram will extend from *c* to *C*, the engine will be on the forward dead center.

All the other centers must be found by a similar process.

TURNING WHEELS AND MOVING ECCENTRICS.

When a measurement is going to be made for fore gear, the wheels must be turned forward, and when it is for the back gear they must be turned backward. Enough movement of the wheel must be given to take up the lost motion every time the direction of movement is changed. In moving an eccentric, it should also be turned far enough in the opposite direction to take up the lost motion.

SETTING BY THE LEAD OPENING.

Put the reverse lever in the full forward notch, and place the engine on the forward center. If the lead opening in full gear is to be $\frac{1}{16}$ inch, advance the forward eccentric till the point *a* on the valve stem is that distance away from the tram point. Throw the reverse lever into the full backward notch, turn the wheels forward enough to take up the lost motion, then turn them back to the forward center. Move the backward eccentric (if it needs moving) till the tram, extended on the valve stem, strikes the same point that it reached for the forward motion. It will be noted here that the valve occupies the same position for fore and back gear when the engine is on the center. Put the reverse lever in the forward notch again, and turn the wheels ahead till the back center point is reached. Now tram the valve stem again, and, if the lead opening be the same for both gears as it was on the forward center, that part of the setting is right. It is a good plan to go over the points a second time to prove their correctness. But it is not likely that the lead opening at the back end will be right on the first trial. Instead of having the correct lead, the valve will probably lap over the port, being what workmen call "blind," or it will have too much lead. Let us assume that our valve is $\frac{1}{16}$ inch blind. This indicates that the eccentric rod is too long. We shorten the rod till the valve is at the opening point, and on turning the engine to the forward center again we will find that the valve there has lost its lead. But our change has adjusted the valve movement, so that on each center the valve is just beginning to open the steam port. Advancing the eccentric to give one end $\frac{1}{16}$ inch lead will now have the same effect upon the other end; and, assuming that the back motion has been subjected to similar treatment with a like result, the lead opening on that side is right. This process must now be repeated with the other side of the engine.

ASCERTAINING THE POINT OF CUT-OFF.

The lead openings being properly arranged, we will proceed to examine how the valves cut off the steam, for it is important that about the same supply of steam should be furnished to each cylinder and to each end of the cylinders. The angularity of the connecting rod tends to give a greater supply of steam to the forward than to the back end of the cylinder, but this inequality is, as has already been explained, usually rectified by locating the hanger stud a certain distance back of the link arc. To prove the cut-off, we will try the full gear first. Put the reverse lever in the full forward notch, starting from the forward center, and turn the wheels ahead. The motion of our engine has been designed so that the cut-off in full gear shall happen at 18 inches of the stroke. With tram in hand, watch the movement of the valve as indicated by the stem marks. As the piston moves away from the forward end of the cylinder, the valve will keep opening till nearly half stroke is reached, when it will begin to return, slowly at first, but with increasing velocity as the point of cut-off is reached. When the point *a*, Fig. 3, gets so that it will be reached by the tram extended from *c*, the motion must be stopped, as that indicates the point of cut-off. Now measure on the guide how far the cross-head has traveled from the beginning of the stroke, and mark it down with chalk. Then turn the wheels in the same direction past the back center, and obtain the cut-off for the forward stroke in the same manner. The cut-off for the other cylinder will be found in precisely the method described. In addition to trying the cut-off in full gear, it is usually tested at half stroke and at 6″, or with the reverse lever in the notches nearest to these points. Some men begin at the first notch, and follow the point of cut-off in every notch till the center is reached, and do the same for back gear.

ADJUSTMENT OF CUT-OFF.

From various causes it often happens that the cut-off is unequal in the two strokes, or one cylinder may be getting more steam than the other. Suppose that on one side of the engine the valve is cutting off at 18½″ in forward gear, while at the other side it is cutting off at 17½″ of the stroke. The most ready way to adjust that inequality is by shortening one linkhanger and lengthening the other till a mean is struck. Where the discrepancy is smaller, it is adjusted by lengthening the hanger at the short side.

A harder inequality to adjust is where the valve cuts off earlier for one end of the cylinder than for the other. In new work this is readily overcome by the saddle stud, but such a change is seldom admissible in old work. When the points of cut-off have been noted down, it will frequently happen that instead of both ends cutting off at 18″, one end will show the cut at 17″, while the other goes to 19″. This indicates something wrong, and demands a search for the origin of the unequal motion. First ascertain if the rocker arm is not sprung. If that is all right, examine the link, which is probably sprung out of its true radius. To straighten the rocker arm is an easy matter, but not so with case-hardened links, although some men are very successful in springing them back. Where it is impracticable to remedy an unequal cut-off by correcting the origin of the defect, several plans may be resorted to for obtaining the required adjustment. One of the most common resorts is to equalize the forward motion by throwing out the back motion. Putting the rocker arm away from its vertical position when the valve is in the middle of the seat, by shortening or lengthening the valve rod, provides a means of adjustment. Sometimes the equality of lead opening is sacrificed to obtain equality of cut-off. The changes necessary to obtain adjustment of a distorted motion can only be successfully arranged by one who has experience in valve setting or in valve motion designing.

In many shops the cut-off is adjusted for the point where the engine does most of the work—say at 6″. Other master mechanics

direct the equalization to be made for half stroke, while some take the mean between the half stroke and the ordinary working notch.

The final adjustments in valve setting ought to be made when the engine is hot.

A Return Tubular Locomotive Boiler.

From Mr. Pierce Butler of the Brooks Locomotive Works, we have received a drawing and description of the Coventry return tubular boiler which is being applied to a locomotive under construction in those works. The cylinder of this boiler is divided horizontally into two separate parts, each part being filled with flues. The flues of the lower section convey the gases of combustion from the fire-box to the smoke-box where they pass into the upper flues and return through the boiler to the smoke stack, which is on top of the fire-box, filling the place the dome usually occupies. The patentee of this boiler expects by the return tubular arrangement to get more thorough combustion and the utilizing of a greater proportion of the heat units in the fuel than is possible with the ordinary locomotive boiler. He also expects that the use of this boiler will prevent the throwing of sparks.

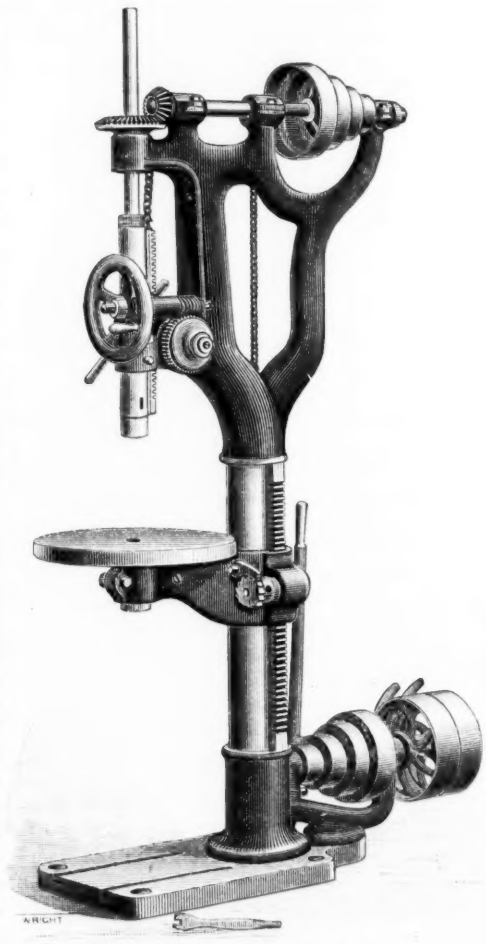
If, in this instance, the return tubular boiler is applied successfully to locomotive practice, we have no doubt but it will be a decided advance in the interests of economical generation of steam. We are, however, by no means sanguine of the result. In this experiment part of the flues in the upper chamber will be above the water line, and we hardly think they will stand the intense heat which must pass through them when the engine is working hard.

This is not by any means the first attempt made to apply the return tubular principle to locomotive practice. If we mistake not, Millholland took out a patent over thirty years ago for a boiler constructed after this plan. In 1869 a patent was granted to one Franklin for a kind of return flue locomotive boiler which never met with any application. In 1875 W. H. Richardson received a patent for a return flue locomotive boiler, and a cut of his arrangement is shown on page 163 of the Report of the Railway Master Mechanics Convention of 1883. In comparing the Richardson and Coventry boilers we are at a loss to find any point about the latter that is not covered by the former.

The Master Car Builders' Association will hold its annual convention at Saratoga Springs, N. Y., June 10th. The Master Mechanics' Association will hold its annual convention at Long Branch, N. J., June 17th.

The large single-driver locomotive built by the Baldwin Works in 1880, and numbered 5,000 of that company's build, is offered for sale in England. This engine, it will be remembered, was intended for running fast trains on the Bound Brook route, and great attention was drawn to her performance at the time she was first tried, the work done forming the text for several treatises on fast running. The engine was not, however, satisfactory for the purpose of running heavy trains at a high rate of speed, and she was not accepted by the Philadelphia & Reading Company. Shortly after the prominent trials of her speed, the engine was bought by the late Mr. Eames, and taken to England to advertise the vacuum brake. There she was hardly a success, except as being something conspicuous. The cab and smoke-stack were too high for English railway bridges, and had to be cut down, and the fire-box was not adapted to burn English coal. The engine has stood idle in the house most of the time she has been in England, and now the owners have decided to sell her. They advertise her as the "powerful American locomotive, Lovett Eames," and by most English engineers she will be regarded as a typical American locomotive, which is a decided mistake. The engine was an unsuccessful attempt to Anglicize an American locomotive, and the result was a machine that represents the locomotive design of no nation.

A most extensive suspension of workmen has recently been made in the Philadelphia and Reading railroad shops at Palo Alto. Two-thirds of the whole force were ordered out, but the men came together and arranged to divide the work into three equal shifts of two days each, so that none has total idleness. This wholesale reduction of force was not rendered necessary because work was dull on the Philadelphia and Reading Railroad, or because the repairing and construction of rolling stock was so advanced that it was desirable to curtail the work. Instead of that being the case, it has been admitted that the full force of men was needed to keep up the equipment and prepare for the heavy traffic of the coming winter. The sole cause of the reduction was an order from the stock-jobbers, who ordered that surplus earnings should appear to be made, no matter by what iniquitous means that end was brought about. This is the same process of making profit as that of the man who starves himself to save money, only in this case the workmen are those who starve. But it has been repeatedly demonstrated that permitting railroad equipment to go without the necessary running repairs in order to manufacture surplus revenue, is putting a road on the shortest route to a receiver's hands. The financial standing of the Philadelphia and Reading Railroad is by no means elevated, and this palpable attempt to make a fictitious income may profit a few unscrupulous stock-jobbers, but it will help to push a magnificent property down the hill.



NEW TWENTY INCH DRILL.

New Twenty Inch Drill.

The engraving represents a new drill, made by W. P. Davis, of North Bloomfield, N. Y., the construction being quite clearly shown. The spindle is of steel, is counterbalanced, has vertical feed of 12″, and quick return. It is geared two to one. The gears and rack are cut from solid metal, the feed pinion from steel and the rack from Swedish iron. The cone pulley has four changes for 2½″ belt.

The swing is 20½″; the table is 17½″ diameter. The spindle is fitted for Morse taper weight complete 600 lbs.

The city of Toronto, Canada, is to celebrate its semi-centennial with a week's festivities, beginning Monday, June 30th. Wednesday, July 2d, is "Trades and Industrial Day." The parade is to comprise (1), members of labor organizations in the city, each with a tableau illustrative of the trade followed; (2), representatives, with illustrative tableaux, from railway, telegraph, express and manufacturing companies, Board of Trade, etc., and wagons or floats laden with goods dealt in, artistically arranged, from each firm doing business in the city.

The Troy *Evening Standard* says: "The Troy Laundry Machinery Company is to establish a laundry in London. The enterprise will be organized with help from this city, and the young ladies who are to show our English cousins how to wash and iron will be absent six months. Besides receiving good wages, their passage will be paid each way, and they will be given three weeks' vacation, with full pay, to see the sights before they return."

Industrial Notes.

It is believed by many business men that rock-bottom prices have been reached in nearly every department of our industries. Already there are symptoms of a slight recuperation, growing out of two or three influences which deserve recognition. Chief of these is the restriction which is in progress; second, the combinations of manufacturing interests to arrest competition, not only by restriction, but by combination; third, the effects of the absorption of stocks in consumers' hands, and the consequent growth of demand for material with which to carry on operations through the summer and fall. These three are the principal influences, which are now working in a favorable direction. What the outcome will be it is impossible to say. The strongest industrial feature on the other hand is the large amount of idle capacity which is eagerly and hungrily waiting for an opportunity to work and make profits. As nearly as it is possible to estimate, 20 per cent. of the productive agencies of the United States, including labor, is idle, and in some respects this percentage is greatly exceeded. In some few directions, however, capacity is engaged to its fullest extent, and overtime is reported. In the great majority of cases, however, there is a restriction in the volume of production. At present writing there is some difficulty in adjusting prices for iron-working in the West. Private advices show that, whatever the decision in the matter may be, there is a difference of opinion among the manufacturers as to what is the best course for them to pursue, and as to the probable outcome. Some of them would prefer to pay present prices and continue production. They believe that it is impossible to break the power of the Amalgamated Association, and do not believe it would do much good if they were to succeed. Then, again, the harmonious action of the manufacturers between Pittsburgh and St. Louis, Bay View and Chattanooga, is to be doubted. It is hard to foresee the effects of a general suspension.

Outside of the iron trade proper, there is a fair movement of material of all kinds. The barbed wire manufacturers are having a heavy run. The wrought-iron pipe manufacturers are holding their combination. The nut and bolt manufacturers will hold a meeting in Cincinnati in a short time. Combinations in every direction are trying to restrict production, so as to meet only the most pressing requirements. Stocks are light. Bridge works are fairly busy. Orders for locomotives are not sufficient to enable the makers to continue their present labor force. The Baldwin Locomotive Works, in Philadelphia, are discharging a squad of workmen every Saturday, and will continue to do so until they are down to 1,500 men, or about half their full capacity, unless orders come in more freely. Meanwhile it is to be hoped that railway managers will soon begin to order some of their much needed equipment.

Drawing School of the Franklin Institute.

The drawing school in connection with the Franklin Institute of Philadelphia appears to be prospering and doing a good educational work. We have received from Mr. Wm. H. Thorne, director of the school, the annual report for last season, which appears to indicate gratifying progress. There are five distinct classes each being carried on under a competent teacher. They consist of junior mechanical, intermediate mechanical, senior mechanical, architectural and free-hand drawing. In the senior mechanical drawing class some complete machine of an interesting nature and good design is taken as a study, its use, operation and construction explained, and the class is required to make detailed drawings of it to scale, after the manner of our best drafting offices, special attention being given to accurate measurements, the proper use and distribution of dimension lines and figures, the employment of section and shade lines, and all the technicalities of mechanical drawing. The other classes are conducted in a similarly comprehensive manner.

We clip the following useful notes for engineers from the *Locomotive*, published by the Hartford Boiler Insurance Company:

Among the questions most frequently asked of our inspectors when making their ordinary visits are the following, which are of such general interest to engineers as to warrant publication:

1st. How much water per pound of coal should be made into steam at 60 pounds pressure per square inch with 60-inch tubular boilers properly made, well set, and carefully fired?

Under the above conditions, from 8 to 10 pounds, dependent somewhat, of course, upon the quality of the coal, and the temperature of the feed water.

2d. How much more coal per pound of water does it take to carry 80 pounds per square inch than it does to carry 60 pounds per square inch?

This question could with more propriety be put as follows: How much more heat does it take to make a pound of steam at 80 pounds pressure per square inch than it does to make a pound at 60 pounds per square inch?

Practically, no more coal will be required; *theoretically*, about $\frac{4}{10}$ of one per cent., or about $\frac{1}{250}$ part more.

3d. Do you get enough better results from steam of 80 pounds per square inch than you do from steam 60 pounds per square inch to pay for the extra wear and tear of boiler and engine?

Depends entirely upon conditions: If you can *make use* of steam of 80 pounds pressure, it pays to use it; there are conditions, however, where 60 pounds, or even less, would be decidedly more economical.

4th. How much more heat do you get from pipes carrying 60 pounds pressure than from pipes carrying 10 pounds pressure?

Two and one-tenths per cent. more heat will be given out per pound condensed from steam of 60 pounds pressure than from steam of 10 pounds pressure, in falling from the temperature due to the respective pressure to 212° Fahr.

5th. What proportion of direct heating surface to the volume of a fairly protected room is required to maintain the temperature of the room at 60° Fahr., in buildings heated by steam?

From $\frac{1}{75}$ to $\frac{1}{250}$, according to size and exposure of room.

6th. How much is a given amount of steam reduced in bulk by compressing it from 60 pounds per square inch to 80 pounds per square inch?

About 20 per cent. See any steam table.

Decatur, Ga., is a quaint old town, which forty years ago refused to allow a railroad station to be built there, and thus made way for Atlanta, six miles further up. The town Council passed two ordinances on the 6th—one forbidding children to play marbles on the streets, and the other allowing hogs to run at large.—*Engineering News.*

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NEW YORK, JUNE 7, 1884.

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Promoting Manufactures in New Towns.

One of the favorable signs of the times is the formation of merchants' and manufacturers' associations in several young and growing towns, especially in the West, to aid and encourage the erection of manufactories and other enterprises calculated to enhance the growth and prosperity of the town. These associations are the natural outgrowth of the competition among towns to secure the locating of new productive enterprises, when their projectors are ready to accept the most favorable offers of aid.

In some instances, a fund has been raised to advertise the advantages the town offers, and a spirit of public progress has been stimulated that is not likely to die out. The desire for new manufacturing establishments is common to all enterprising towns, as their advantages are generally recognized, but in most localities the citizens have adopted no co-operative and efficient plan to promote them. What is needed is organization of merchants and manufacturers, with the definite end in view of increasing local productive industries. Boards of Trade and Chambers of Commerce are mostly too conservative to aid new manufacturing developments. Their efforts are almost wholly directed to the protection and advancement of industries already established.

Another benefit that should follow the organizations of merchants' and manufacturers' associations in young, progressive towns is a watchfulness tending to prevent municipal extravagance. The opposition of such associations to schemes to bond the towns excessively for all sorts of so-called improvements, and to squander a large part of the proceeds, thus involving heavy taxation, would carry vastly more weight with the people than the opposition of political cliques, whose motives are always open to suspicion. Most of the older and larger municipalities have become so loaded with taxes, through insufficient attention by business men to public affairs, that there are few inducements for new manufactories to locate within their corporate limits. The worst feature of the situation is that a new era of public economy can bring but slow relief, as a large portion of the money raised by taxation must go to pay interest upon bonds issued to support previous extravagance. It is to new towns, unincumbered with such burdens, that new manufacturers will turn their attention. No special exemption from taxes is needed, but a general exemption of all classes of industry and all property from excessive and unnecessary taxation. Towns having natural advantages, and that furnish aid to new manufactories at the outset, and take early measures to prevent burdensome taxes, are the ones that will enjoy solid and lasting prosperity.

Maintaining Mile a Minute Speed.

The paper which Mr. Le Van read at the Pittsburgh meeting of the Society of Mechanical Engineers, and of which an epitome is given on another page, displays very little knowledge of the real difficulties encountered in running fast trains. The fact that under the most favorable circumstances trains are occasionally run for a mile or two at a speed of seventy or seventy-five miles an hour, is assumed as conclusive proof that a speed of sixty miles an hour can easily be maintained. Now it is well known to all men familiar with railroad operating that every road has curves that cannot be safely traversed at a speed over forty miles an hour, and the road over which Mr. Le Van proposes running his seventeen-hour train has long grades that no locomotive ever built will ascend at a speed of sixty miles an hour and pull three Pullman cars. In addition to erecting safety gates, the Pennsylvania Railroad Company would need to level down their grades and straighten out the curves on the road before maintaining a mile a minute speed is practicable. Some of the calculations made by Mr. Le Van are curious in their wideness of the mark. For slowing up at thirty-four grade crossings he allows a loss of twenty minutes. If any locomotive engineer can reduce the train speed from sixty miles an hour to thirty miles an hour, run forty rods at that speed and not lose more than two minutes, he will handle his engine with extraordinary skill. In addition to the delays for grade crossings a margin ought to have been left for taking water. Mr. Le Van evidently believed that since the locomotives "picked up" water while running, that no loss of time was due to that operation. A closer knowledge of train operating would have informed him that speed must be reduced to about twenty miles an hour while taking water out of track troughs. Twelve delays of this kind would make another deep inroad into the running time.

Mr. LeVan meets with only one real difficulty in maintaining the high speed needed to run a train to Chicago in seventeen hours. The link motion, in his opinion, does not distribute the steam properly. Indicator cards which he shows from a locomotive running at a speed of about sixty miles an hour, indicate only sixty-five per cent. of the theoretical diagrams, while stationary engines of similar capacity with automatic cut-off valves show an average of ninety per cent. From this he assumes that the narrow port openings due to the link motion are responsible for a loss of over thirty per cent. of power. The remedy proposed for this supposed iniquity is an independent cut-off valve.

It is not readily apparent how the link motion could possibly be responsible for the loss claimed in Mr. Le Van's figures, but it is the fashion at present among certain engineers to abuse the link motion, and that probably influences the calculations. To make a locomotive agree with the conditions of an ordinary automatic cut-off engine, more change would be needed than merely putting on an independent cut-off valve. The cylinders would have to be renewed, for the locomotive would need to have its steam ports very much enlarged to make their capacity of the same proportion as automatic engines. No builder of an automatic cut-off engine that had to make a piston speed of 1100 feet a minute would dare design his engine with ports so small as we find to be common in locomotive practice. Some of our mechanical writers who have so much to say against the link motion forget, or are not aware, that independent cut-off valves have been thoroughly tried on locomotives in this country and in Europe, and that they have been rejected deliberately. The Corliss motion has been repeatedly tried on American locomotives and was the worst kind of a failure. There are locomotives equipped with the link motion, running with an expenditure of coal about the same as ordinary steamboat compound condensing engines. That does not indicate an extravagant waste of steam. The master mechanics and other engineers best able to judge of the value of different forms of motion for high-speed locomotives are the men who have the least fault to find with the link motion.

The traditional wooden nutmeg manufacturers of Connecticut will be interested in the following announcement, which we find in the *Baltimore Manufacturers' Record:*

"L. H. McKinstry, of Minnesota, will probably start a peanut factory in Claremont, Va. Claremont Manufacturing Company can probably give particulars."

Here is apparently a new Southern industry. The growing of peanuts has long been an important agricultural pursuit in Virginia, but the process is necessarily a slow one. Articles as small as peanuts can be manufactured in a jiffy and in large quantities. Why, then, cling to the old-fashioned slow way of growing them in the soil? Besides, the parties above mentioned can doubtless give particulars that will convince the most skeptical that the manufactured peanut has a decided advantage over the unimproved agricultural article. But a difficulty is likely to arise in introducing the new peanut. Will they try to sell it for the old-fashioned article, thus following the plan of the oleomargarine makers, who, while claiming to show proofs that their product is better than real butter, make the purchaser believe he is getting butter? If so, they will certainly fail, for the American small boy will not be imposed upon. He will rise in his might and overcome the vendors of the sham goober. Bogus butter will sell, but sham peanuts never.

Inventing Station Indicators.

American railroad brakemen, as a rule, talk tolerably plain, but their utterance of station names often fails to convey to anxious passengers the name of the station the train is approaching. Few persons who find fault with the enunciation of brakemen could shout the name in a plainer way if they were induced to try. When this truth becomes apparent to the ordinary run of travelers, they naturally inquire, why not exhibit the name of next station so that every one who rides can read? A sequel question from the man of inventive tendencies is, why not make an automatic station indicator that will not need attention from brakemen? The feat of inventing an indicator that will automatically change when a train is stopped at a station, and thereby be ready with the new announcement, appears simple enough, and lures the inventive man onward. After the exercise of great ingenuity, backed by patience and perseverance, he produces an arrangement whereby the wheels of the car are called upon to operate a station indicator. The names of the stations on the railroad are marked on cards of proper size, which are required to be exhibited in correct rotation. The apparatus operating the cards is so constructed that the stoppage of the wheels changes the card. To bring this arrangement to a successful issue requires much thought and labor, but it is accomplished at last, and the inventor is ready to supply the station indicator to all railroad companies. When he begins to look for purchasers he is astonished to find that railroad companies have no faith in his invention; and when, after much difficulty he prevails upon a manager to permit him to put a station indicator upon a train without expense to the company, he is beginning to meet with the real difficulties of the case. He then discovers that trains sometimes stop between stations, and that disarranges the work of his machine. It would be easy to devise a compensating arrangement whereby the brakemen would stop the machine from changing the name of the station when an extra stop was made, but he wants it to be purely self-acting, and the apparatus is taken off to be further perfected.

Another inventor has perceived the disturbance that would result from extra stops, and he has labored to produce a station indicator operated on a time basis. The cards are operated by clockwork, and are changed at the time the train ought to be starting from a station. The difficulty encountered here is irregularity of trains, so that slippery rails, a side wind, or a hard-steaming engine is liable to mix up the stations, and send the passengers out at the wrong places.

A third class of inventors in this field are more discriminating as to the difficulties to be overcome in the station indicator problem, and they labor to produce a machine where the distance run will regulate the changing of the name cards. The revolution of the car-wheels is used to measure the distance, but a disturbing factor intervenes in the habit of wheels slipping backward when running rapidly down-hill, and also in their losing the proper number of turns in going round curves. In whatever form the inventing of a station indicator is tried, new and unforeseen obstacles arise in the way of successful application; yet American inventive talent seems to be stimulated into action by the difficulties of the case, for the Patent Office records show a wonderful activity in this line of invention. Few weeks pass without a patent for a new station indicator being granted.

British machinery dealers are looking with longing, eager eyes to the Western Canadian territory as a market that will relieve the depression of the home trade. Somehow the expectation is cherished that the unbroken prairies and virgin forests will have a teem-

ing population quickly imported, and that a great demand will arise for wood-working machinery, agricultural implements, and other machinery which must be supplied from British workshops.

One of the latest applications of science to domestic purposes is the invention of a magnetic rat trap. The inventor proposes to so manipulate magnets that they will close a trap door when the deluded rat seizes hold of an enticing bait. As a suggestion, we would draw attention to the possibility of using a strong electric current for annihilating the destructive rodents. We noted a week or two back the case of a horse that was suddenly sent to the happy hunting grounds through touching an electric conductor with its nose. Could our ingenious inventors not arrange some inducement that would bring rats' noses in connection with an electric conductor, and so finish them off in a prompt and business-like manner?

At a recent meeting of the British Society of Mechanical Engineers, Mr. Tomlinson, locomotive superintendent of the London underground railways, gave particulars of experiments he had made with locomotives in trying to reduce operating expenses. He usually worked the engines with a boiler pressure of about 130 pounds, but thinking to save coal by the operation he increased the pressure to 160 pounds, taking an exact record of all expenses. At this pressure he found that the extra expense of keeping pistons and packing was greater than the saving in coal paid for.

The bill to loan a million dollars from the U. S. Treasury to the New Orleans World's Fair has passed both Houses of Congress. The board of management of this exhibition is appointed by the President of the United States. The exhibition building will be the largest ever erected for the purpose.

The first of a series of papers on "Early Engineering Reminiscences," which we present this week, is from the pen of a near relative of two of the best-known American mechanical engineers. For the present he does not wish to have his name published, but we feel confident of persuading him not to remain anonymous. He gives notes of engineering practice, this week, as he observed it sixty-eight years ago.

A Nova Scotia reader who commends the AMERICAN MACHINIST very highly, and says he has all the numbers bound, writes us: "Among the many interesting notices in the AMERICAN MACHINIST of the 24th inst. I read an article on 'Exclusiveness in Machine Shops.' Why, sir, you cannot get into a shop in Massachusetts that will not tire your patience waiting to be admitted. I went to see some friends in South Boston who work in iron foundries and had a hard time to get in to see them, so that exclusiveness is not any more amongst English shops than American. I can name a hundred shops where the first thing that meets your eye is 'No Admittance.' I want it understood I am an American and boast of American mechanics. At the same time American shops are as hard to get admittance to as any shops in England, Ireland or Scotland."

Our Nova Scotia correspondent has mistaken the tenor of our recent editorial on exclusiveness in shops. He seems to have the impression that we favor the keeping of "open house" by proprietors of shops and foundries so that the workmen can have their friends enter at will and carry on a conversation as long as they choose. Such regulations, or rather the absence of regulations, would make the work in most shops cost more than it sells for. It would mean bankruptcy and ruin in shops otherwise well conducted. We never found a shop with "No Admittance" posted over the office door. Any one wishing to visit a shop should apply for permission at the office. If he wishes to see how the shop is equipped and how the work is done, and not to bother the men at work, we speak from experience when we say he will find very little difficulty in getting into shops in Massachusetts or any other State.

QUESTIONS AND ANSWERS.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common sense methods.

Every question, to insure any attention, must invariably be accompanied by the writer's name and address. If so requested, neither name, correct initials, nor location will be published.

(225) J. C. R., York, Pa., asks: In making surface plates, is it necessary to work at more than one at once? *A.*—Unless the plate is worked up from a master plate, it is necessary to work at three plates, trying them together alternately.

(226) A. R., Columbus, O., writes: Can you tell us why our engine back-lashes in passing the centers. It is 20″x48″, running 52 revolutions, and has a fly-wheel 15 feet diameter, weighing about 4,800 lbs. The valve has 1″ outside and 7-16″ inside lap; travel 4⅜″. The boiler pressure is 80 lbs. *A.*—The trouble is in having too light fly-wheel. If the wheel is 15 feet diameter, the *rim* should weigh about eight tons.

(227) Mechanic, Salem, Mass., asks: 1. Will the exhaust steam from an engine heat the feed water higher than 212° in a coil heater; and, if not, why not? *A.*—Unless there is considerable back pressure in the heater it will not heat water higher than 212°, because the temperature of steam at the pressure of the atmosphere is only 212°. 2. Will an injector that will work at 60 lbs. pressure fail to work at 100 lbs. pressure? *A.*—No; not if it is in good order. 3. What causes a steam gauge to vibrate when the engine is running? *A.*—Fluctuation of steam pressure.

(229) L. C. H., Cleveland, O., asks: 1. Of two air chambers, one contracted at the base and the other not, which will be the most effective? *A.*—We do not think there will be any difference, provided the contraction is not so great as to seriously reduce the communication. 2. Suppose the air chamber to be placed horizontally, what will be the difference? *A.*—The air chamber will in any case partially fill with water, which by its gravity will be at the bottom. With the air chamber disposed vertically, the height of the column of air above the water will be greater, and hence will possess greater elasticity.

(229) W. S., Baltimore, Md., writes: I havs a ½″ water pipe 20 feet from ground floor through which I can get 32 lbs. of water per minute. I wish to construct a cylinder water motor. What sized cylinder must I have to run 150 revolutions per minute, and can I get 1-6th of a horse-power from it? *A.*—32 lbs of water is about ½ cubic foot, or 864 cubic inches, and 864÷150=5.7 which in cubic inches is all the water you can use per stroke. Allowing for clearance, the displacement of piston could not be more than about 4½ inches. This you could get from a cylinder, say 1⅝″x1½″. The full effect of the amount of water named working in such a cylinder would be less than 1-6th horse-power, and when friction was deducted it would not probably be one-half that. We do not think the motor, under the circumstances named, would be a success.

(230) F. R. K., Camden, N. J., asks: 1. What is the tensile strength of cast iron, and does not the strength decrease as the hardness increases? *A.*—The tensile strength of cast iron, as made into castings, varies all the way between five and twenty tons per square inch of section. The strength does not necessarily decrease as the hardness increases. Medium grades are generally stronger than those very soft or very hard. 2. What is the tensile strength of brass castings? *A.*—The strength of brass and bronze castings varies between eight and twenty-five tons per square inch of section. 3. What process is used for hardening brass? *A.*—Brass or bronze castings are made hard or soft by different mixtures of metals. 4. Will a pair of dies made for ⅝″ rod cut as strong a thread on a ½″ rod? *A.*—If the dies are exactly right for ⅝″ rod, they will not cut as strong a thread on the ½″ rod as if made for it.

BUSINESS SPECIALS

Transient Advertisements, 50 cts. a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday for the ensuing week's issue.

Mackenzie Cupolas and Blowers, 245 Broadway, N.Y.

Springs—List free. T. F. Welch, 11 Hawkins st. Boston.

Presses & Dies, Ferracute Mach. Co., Bridgeton, N. J.

Steel Name Stamps, &c. J. B. Roney, Lynn, Mass

Interchangeable work a specialty. Send stamp for new Lathe Catalogue. E. O. Chase, Newark, N. J.

For first-class machine patterns and estimates, address John Valentine, 15 Alling st., Newark, N.J.

INVENTIONS perfected, designed, or patented. E. P. Robbins, M. E., Cincinnati, O.

"How to Keep Boilers Clean." A book mailed free, by James E. Hotchkiss, 86 John street, N. Y.

Fine tools and special machinery. Horace Thurston, 84 Clifford street, Providence, R. I.

Lyman's Gear Chart. How to lay out gear teeth. Price 50 cents. E. Lyman, C. E., New Haven, Conn.

Wood Engraving done in best manner. Designs furnished. Edward Sears, 48 Beekman St. New York.

Foot Power Machinery, for workshop use, sent on trial if desired. W. F. & John Barnes, Rockford, Ill.

The latest Improved Tack and Match Machinery is made by White Machine Co., Waterbury, Conn.

Pattern and Brand Letters. Vanderburgh, Wells & Co., corner Fulton and Dutch streets, New York.

Consulting Engineer and Mechanical expert, C. C. Hill, 84 Market street, Chicago, Ill.

R. Dudgeon, 24 Columbia st., New York, Improved Hydraulic Jacks and Roller Tube Expanders.

Herbert W. T. Jenner, Mechanical Engineer and Solicitor of Patents, 626 E st., Washington, D. C.

National and box chucks, foot and power lathes, and slide rests. Lodge, Barker & Co., Cincinnati, O.

Guild & Garrison's Steam Pump Works, Brooklyn, N. Y. Steam Pumping Machinery of every description. Send for catalogue.

Improved Tack Machinery, made by The Willets Man'f'g Co., can be seen in operation at their works, 57 Clifford St., Providence, R. I.

The "Wax Process" Engravings shown in the AMERICAN MACHINIST each week are made by Struthers, Servoss & Co., 32 Frankfort Street, N. Y.

Difficult machines invented and built; coarse screws cut. V rotary files for fine milling, by mail 50 cts. Tower Machine Works, E. Brookfield, Mass.

Engine Lathes, Hand Lathes, and other fine tools. Assortment large; prices low. Frasse & Co., 62 Chatham St., N. Y.

I have a well-equipped machine shop and foundry, and would be pleased to give estimates for building any kind of machinery. H. W. Bullard, Poughkeepsie, N. Y.

The Complete Practical Machinist, $2 50; the Pattern Maker's Assistant, $2.50; Mechanical Drawing Self-taught, $4 00; books for practical machinists. Address, Joshua Rose, Box 3,306, New York City.

EXTRACTS FROM CHORDAL'S LETTERS, 400 pages, 12mo., handsomely bound in cloth. New and enlarged edition, with over 50 illustrations. Price $2. Published by John Wiley & Sons, 15 Astor place, New York.

MANUFACTURES.

F. Wentor will erect a $19,000 factory, at 115 West 14th street, Chicago.

F. J. Miller has broken ground at Carrollton, Ky., for a new carriage shop.

Charles H. Phillips, 109 E. 24th street, New York, will erect a 25x92-foot factory to cost $10,000.

The Colorado Iron Works, of Denver, Col., are about to start a branch machine shop at Hailey, Idaho.

The Pratt Manufacturing Company, Brooklyn, N. Y., will put up two new manufacturing buildings, 120x80 feet.

The Marinette Iron Works, Marinette, Mich., are building an addition to their machine shop and putting in new tools.

Machine shops for a branch road are to be built at Monroe, La., by the Cincinnati, New Orleans, and Texas Pacific Railroad.

It is said that a large agricultural implement factory will locate at Owosso, Mich., and give employment to two hundred men.

S. S. & W. O. Webber, Lawrence, Mass., are about to erect a new machine shop and put in new tools. They build printing presses and dynamometers.

Talbott & Sons, engine builders, Richmond, Va., have moved their branch office from Goldsboro, N. C., to Rome, Ga. J. A. Hanser is manager of the branch.

The car shops of the Harlem Railroad in New York City were burned May 18th. Loss about $200,000. They will be rebuilt and newly equipped with machinery.

The Sweetland Chuck Works, Wallingford, Conn., recently burned, will probably be rebuilt and refitted with machinery. The loss was $50,000, and the insurance $35,000.

New car-wheel works are to be built at Birmingham, Ala. Among those interested are C. C. Drake, of Detroit, Mich.; P. B. Warner, Covington, Ky., and W. B. Seaton, Greenup, Ky.

The Houston East and West Texas Railroad propose to enlarge their repair shops in Houston at an early date. Paul Bremond, Houston, Tex., is president and purchasing agent.

The Burnham Grate Company has decided to locate at Birmingham, Ala., and will begin the erection at an early date of an extensive foundry. It will also manufacture mantels and stoves.

The New Orleans *Picayune* is now printed on paper made from bagasse, the refuse of sugar cane, after the juice has been extracted. It is proposed to start a $100,000 bagasse paper mill in that city.

The Louisiana Fiber-Working Company, of New Orleans, expect to add $100,000 to their capital and build a mill to make paper from bagasse. Colonel Louis Bush is interested.—*Baltimore Manufacturers' Record.*

The Great Western Railroad Supply Company, a newly organized company, are conferring with the citizens of Carondelet, Mo., and East St. Louis, Ill., as to inducements to locate their shops in one or the other of those towns.

The contractors in charge of the erection of West Shore Railroad shops, at Frankfort, N. Y., work on which was suspended last December, have received instructions to resume work and complete the shop, foundry, and boiler house in six weeks.

The Excelsior Manufacturing Company, of St. Louis, are experimenting with wire-gauze doors on their boiler fire-fronts. As yet the tests have not progressed far enough to determine whether their employment effects a saving of fuel or not.

Manufacturers and dealers in spoke machinery report an unusually large demand for this class of machinery, especially from the Southern and Southwestern States.

Somers Brothers, Front and Pearl streets, Brooklyn, N. Y., manufacturers of special machinery, are about to build new works. One building will be 58x205 feet, four stories high. The engine house will be 30x49 feet. The whole will cost $60,000.

The Texarkana Foundry and Machine Works, Texarkana, Ark., will have capital stock of $500,000. President, J. H. Droughn; vice-president, L. W. Lloyd; secretary and treasurer, G. W. Fouke. Work on buildings will be commenced at once.

The Bradley & Hubbard Company, Meriden, Conn., is building an addition of brick to its factory, which will be used as a press-room for stamping brass work. Some very fine machinery will be used in it, and work will begin there as soon as the shop is completed.

The New Era Gage Company, of Buffalo, N. Y., manufacturers of the duplex steam pumps, have recently put up a new factory, 80x100 feet, four stories high, and fitted it with new machinery. The company now employs about sixty men and reports business brisk.

At Calera, Ala., the Nottingham Land and Furnace Company has been incorporated with $50,000 capital, to build an iron furnace and other manufactories. J. D. Hardy, of Calera, and G. F. Anderson, A. J. Fox, and William Anderson, of Niles, Mich., are the incorporators.

George B. Grant, Alden street, Boston, Mass., will move June 1, to 66 Beverly street, where he will have double the shop room and facilities he now has. He is putting in machinery for cutting gears to six feet diameter, as well as new and improved apparatus for cutting racks and internal gears.

The new shops of the Peninsular Car Company, of Detroit, Mich., will cover nearly twenty-three acres of ground. The buildings will be of brick, and will embrace an erecting shop, wood machine shop, brick shop, engine house, boiler house, wheel foundry, blacksmith shop, soft casting foundry, and a number of offices, storehouses, etc.

The *Meriden* (Conn.) *Republican* says the Chapman Manufacturing Company is erecting a building 30 by 30 feet, which will be devoted to the manufacture of a new style of harness trimming, which the company propose to put on the market. It is an imitationof rubber finish, and buckles, terrets, ring, and other trimmings will be made out of it.

The Pratt & Whitney Company, Hartford, Conn., have shipped this month (May) to Boston and Providence Railroad one 27″ gap lathe and one 48″ boring mill; to a sewing machine company in Glasgow, Scotland, thirty milling machines; to C. H. Pillsbury & Co., Minneapolis, Minn., a machine for regrooving or sharpening chilled cast-iron rolls for milling wheat; to Calumet and Hecla mine, Calumet, Mich., three 21″ engine lathes, 12 feet bed, with combination lathe chucks and other modern attachments.

J. F. Wollensak, of Chicago, is building an addition to his factory, 40x100 feet in extent, to make room for new machinery which will be put in as soon as the building is ready. This addition, which will also relieve the crowded state of his present work, will be five stories high and substantially built of brick. It will be used for the manufacture of locks, keys, and light hardware specialties, and will increase his capacity 50 per cent. It will be completed early in June.—*Industrial World.*

W. P. Davis, North Bloomfield, N. Y., writes us that he is selling many of his drills and key-seating machines. He says: "We are building our machines much better, and the fact that our best shops are using them lead us to think our effort to produce a good machine at a nominal cost has not been in vain. We now use gas for our core oven, and as fuel for boiler and lights. We also use it to heat our steel for tempering, and as we use quite an amount of the best special steel for our cutters, we find it far ahead of coal of any kind. Our castings are all made by the ton. We furnish all material and stock, and pay for all perfect castings. We have a book which is of much use to us, which we had made on purpose for our business, showing each heat, cost of each separate item, so that we can tell what every heat costs us per pound net at any time."

In our issue of April 12th, we illustrated and described a novel pole-road locomotive, designed and constructed by Captain W. E. Cole. We learn that the new machine is meeting with gratifying success. We clip the following item regarding it from the *Montgomery* (Ala.) *Advertiser*, of May 15th; "A pulling match occurred yesterday between one of Capt. W. E Cole's pole-road locomotives and a twenty-five ton railroad locomotive, in which the former was the victor. The pole-road engine had just been finished at the Montgomery Iron Works, and to test its power, three cars were coupled to it and the brakes applied. As this seemed no load, the twenty-five-ton engine was coupled to the other end of the cars and started in opposite directions. To the astonishment of all present, the pole-road locomotive moved off, pulling the engine, cars and all, some forty feet without the least difficulty. This locomotive has three or four times the traction force on poles that it has on rails, and an idea may be formed of its power. After the above-named test, a track was laid at an incline of 1,500 feet to the mile, to the top of a car, and the locomotive made to load itself, which it did with ease. This is the second engine of the kind built, and goes to the saw-mill of Gullahorn & Co., on the S. and N. road The tests that have been made rendered perfect satisfaction to Captain Cole, the inventor, and the Montgomery Iron Works that will build them."

Machinists' Supplies and Iron.

NEW YORK, May 22, 1884.

There is very little change in the supplies trade during the week.

Iron, pig, American—Business continues to run in about the same groove as it has done for several weeks. The demand is limited, sales moderate, and values without quotable change. We quote No. 1 X Foundry, $20 to $21.50; No. 2 X $18.50 to $19.50; Grey Forge, $16.50 to $17.50 at tide water.

Scotch—The demand continues light and the market dull. There is a disposition among dealers to make concession to obtain sales.

✲WANTED✲

"Situation and Help" Advertisements, 30 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday morning for the coming week's issue.

Wanted—Mechanical engineer, as assistant, with five hundred to five thousand dollars; good salary and good position. Address Box 8, AM. MACHINIST.

A mechanical engineer, of good technical education and many years' experience as draughtsman desires a situation. Address S. B., Box 2, AM. MACHINIST.

Wanted—Live Foreman, for a machine shop in Western Canada, on first-class engine and mill work. Apply, with terms, to "Tar," care of AM. MACHINIST, New York.

An experienced, educated engineer desires employment, with chance to advance. Business combining commercial with professional work preferred. Address T. V., AM. MACHINIST.

A student, who has nearly completed the course required in the Hoboken Institute of Technology, in addition to a course in civil engineering, would like employment in either branch. Address C. H. Lindenberger, Defiance, O.

Situation wanted, as foreman of a boiler shop. Have had 20 years' experience as foreman, and am conversant with marine stationary and locomotive work. Address George Marshall, care AMERICAN MACHINIST.

Wanted—A foreman, to take charge of a jobbing machine shop, with about sixty hands. Must be well up in modern methods of turning out work. Address, with full particulars, P. O. box 1,138, Montreal, Quebec, Canada.

Experienced mechanical engineer is open to engagement. Good draughtsman. Has had charge of works. Specialty steam engineering in all its branches; expert with indicator; competent to design, handle men, or travel. Good record; best of references. Address Box 9, AM. MACHINIST.

Young man of thorough practical and fair theoretical experience is open to re-engagement; machines of original design now in use; experienced in shop, drawing-room and office; have made the handling of help and the economical production of machinery a study. First-class reference as to success, executive ability, etc. Address "Energetic," AM. MACHINIST.

Wanted—Lathe to turn 16 feet or more; planer to plane 4 feet or more. Address Samuel Eddison, Holyoke, Mass.

A firm of engineers, having an established business and an extensive acquaintance among manufacturers, would like to open correspondence with some manufacturing concern, with a view of taking the agency for the New York market for some machinery specialties. Can furnish the best of references as to capability and responsibility. Address Room 123, Temple court, New York City.

MACHINE AND ENGINE SHOPS FOR SALE

At MT. VERNON, OHIO.

Machine, Foundry, Boiler, Blacksmith and Wood Shops, fitted with modern tools. All brick buildings and slate roofs. Fire-proof Pattern Warehouse. A first-class plant capacity of 130 to 150 workmen. Now running and in good order. Railroad tracks, water-works and gas on the premises. For health, cheapness of coal or living there can be no better location.

Parties wishing to move from the East, or wishing to engage in this line of business, will find this a rare opportunity. Owners would retain one-third or half interest if desired, or large portion of the purchase money may remain on mortgage. F. WHITESIDES.

MACHINE TOOLS FOR SALE

One Engine Lathe,	2nd hand,	7 ft. x 20 in.
" "	" "	8 ft. x 16 in.
" "	" "	9 ft. x 18 in.
" Upright Drill,	- -	24 in. Swing.
" Iron Planer,	-	5 ft. x 24 in. x 24 in.
" "	" -	9 ft. x 36 in. x 42 in.

ROLLSTONE MACHINE CO., | FITCHBURG, MASS.

FOR SALE OR RENT.

As we shall commence immediately the erection of new buildings, to meet the wants of our increasing business, we offer for sale or rent that part of the buildings owned and occupied by us as a foundry and machine shop. Foundry is 40 x 70 ft.; machine shop, 40 x 70 ft., two story. Warerooms, pattern rooms and office. These buildings will be vacated by us, Oct. 1st, and are situated in the heart of the city of Canton, Ohio. The city contains over 21,000 inhabitants with four railroads and five banks. The shops are admirably situated for jobbing and for any kind of manufacturing for from 25 to 50 men. Cost of coal from 80 cts. to $2.00 per ton; and freight from the Mahoning Valley, Lake Superior Iron Furnaces, only one dollar per ton.

THE MILLER CO., Canton, Ohio.

HILL, CLARKE & CO.

36 OLIVER STREET, Boston, Mass.

BRANCH OFFICE, 800 N. 2nd STREET, St. Louis Mo.

Have just issued new

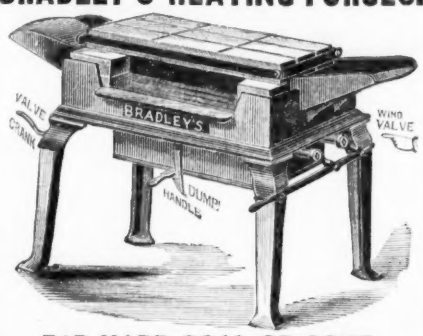
CATALOGUE

—OF—

LIGHT MACHINERY & SMALL TOOLS.

Sent free to Manufacturers and Dealers on receipt of their business card.

BRADLEY'S HEATING FORGES.



FOR HARD COAL OR COKE.

INDISPENSABLE IN ALL SHOPS to keep **Bradley's Cushioned Hammers** and men fully employed, and reduce cost of production.

BRADLEY & CO., Syracuse, N. Y.

(ESTABLISHED 1832.)

All descriptions of Gear Wheels or Gear Cutting to order.

Large variety of Ready-made Gears in Stock.

Send for Gear Book, gratis.

GEO. B. GRANT, - 3 ALDEN STREET, BOSTON.

A BARGAIN.

Three locomotive-pattern **new** steel **BOILERS,** 60" diameter, containing 81 3½"x15'5" tubes, furnace about 8½' long x 5' wide x 6' high. Will carry 120 pounds steady working pressure.

One PLANER to plane 63" wide x 72" high x 23' long, in first rate order.

For full particulars address,

COOKE & CO.,

DEALERS IN

MACHINERY & SUPPLIES,

22 CORTLANDT ST., NEW YORK.

FOR SALE.

The following second-hand tools all in good order and for immediate delivery.

1—12½ in.	Stroke	Slotter.
1—10 in.	"	"
1—30 in. x 30 in. x 8 ft.		Planer.
1—54 in. x 54 in. x 16 ft.		"
1—60 in. x 60 in. x 36 ft.		" widens to
3—9 in. Stroke		Shaper. [6 ft. 9 in.
1—17 in. Swing		Lathe, 8 ft. bed.
1—20 in.	"	" 10 ft. "

HEWES & PHILLIPS IRON WORKS,

Cor. Orange and Ogden Streets,

NEWARK, N. J.

FOR SALE.

The property formerly occupied by THE WOODRUFF & BEACH IRON WORKS, now **HARTFORD ENGINEERING COMPANY.** Said property is unsurpassed as to shops and buildings, conveniently located for transportation by water and rail, with a FIRST-CLASS EQUIPMENT of MACHINE TOOLS, bought within two years, adapted to engine building and general machine work. FIRST-CLASS FOUNDRY; STEAM CRANE, CAPACITY 20 TONS. And the largest collection of PATTERNS of all descriptions in New England.

E. M. BUNCE, Receiver,

Hartford, Conn.

STANDARD STEEL CASTING CO., Thurlow, Penn.

STEEL CASTING TO ANY PATTERN OR WEIGHT. TRENGTH and QUALITY Equal to STEEL FORGING

JUST PUBLISHED!

New and Complete Illustrated Catalogue,

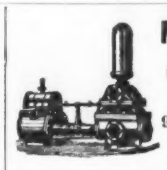
OF BLAKE'S — IMPROVED — STEAM

PUMPING MACHINERY.

SEND FOR A COPY.

Address, GEO. F. BLAKE MANUFACTURING COMPANY

95 & 97 LIBERTY STREET, NEW YORK. | **44 WASHINGTON STREET, BOSTON.**



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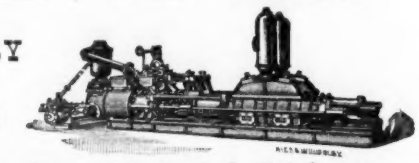
HOLYOKE, MASS.

92 & 94 Liberty St. NEW YORK. | 54 Oliver St. BOSTON | 49 N. 7th St. PHILA. | 226 & 228 Lake St. CHICAGO. | 620 & 622 N. Main St. ST. LOUIS.

MANUFACTURE

STEAM PUMPING MACHINERY

FOR EVERY POSSIBLE DUTY.



Independent Condensing Apparatus A SPECIALTY.

Send for New Illustrated Catalogue.

FRICTION CLUTCH PULLEYS AND CUT-OFF COUPLINGS.

JAS. HUNTER & SON, North Adams, Mass.

A. EDW. BARTHEL,

ENGINEER,

111 LIBERTY STREET, **NEW YORK.** P. O. BOX 2837.

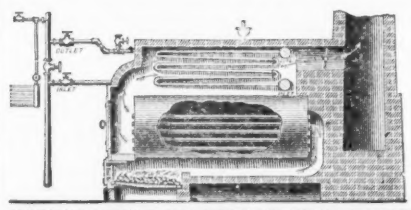
SOLE MANUFACTURER OF THE

REISERT, STAUFFER AND BARTHEL

Lubricators and Solidified Oil.

The most economical, perfect, practical, simplest, cheapest, and elegantly finished Lubricators ever put on the market. One million sold within a couple of years. The **Barthel Solidified Oil or Lubricating Compound** is used with the **Lubricators** exclusively. Whoever has once tried this Lubricant will never again use oil or any other Lubricating compounds. Send for Illustrated Catalogue.

THE DONALDSON RE-HEATER AND SUPER-HEATER.



A practical and scientific invention for Reheating Exhaust, Superheating Live Steam or Heating Air, WITHOUT COST, by utilizing the WASTE HEAT from boiler furnaces. Can be attached to any boiler.

MANUFACTURED BY THE

DONALDSON HEATER COMPANY,

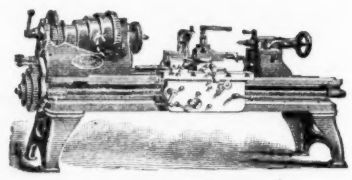
Welles Building,

No. 18 Broadway, New York.

TABLES OF SPEEDS.

Tables of the principal speeds occurring in mechanical engineering, expressed in metres in a second. By P. Keerayeff. Translated by Sergius Kern. Price, 20 cents. Descriptive catalogue of books, 100 pages, free.

E. & F. N. SPON, 35 Murray Street, N. Y.



NEW HAVEN MANFG. CO.,

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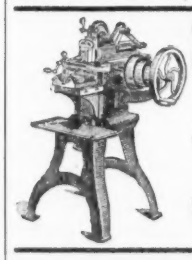
IRON-WORKING MACHINERY,

Planers, Shapers, Drills, Slotters, &c.



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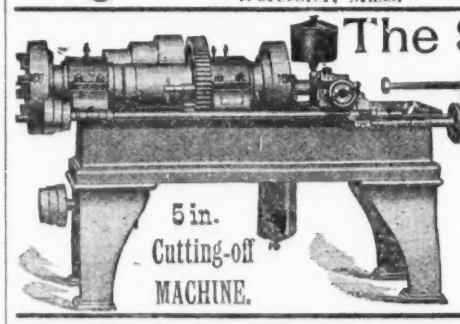
For Hand and Power, 6", 8" and 10" Stroke.

Adapted to All Classes of Work to their Capacity.

CIRCULARS FURNISHED.

BOYNTON & PLUMMER, Worcester, Mass.



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Factory: Providence, R. I.

Offices: 220 Franklin St., Boston, Mass. 228 Lake Street, Chicago. Ill.

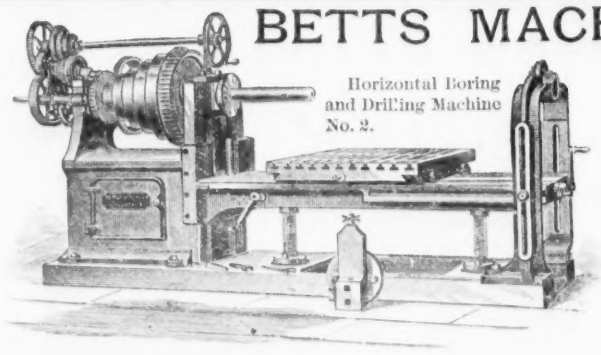
Close Regulation, Best Economy, Simplicity of Valve Gear, and Low Prices, are features of

THE DEXTER AUTOMATIC CUT-OFF ENGINE.

STANDARD SIZES ON HAND OR QUICK DELIVERY.

SEND FOR CATALOGUE A.

DEXTER ENGINE CO., 40 CORTLANDT STREET, NEW YORK.



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BUILDERS OF

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RAILWAY AND MACHINE SHOPS.

NICHOLSON FILE CO.,

SOLE MANUFACTURERS OF

FILES AND RASPS

HAVING THE INCREMENT CUT.

Also, FILERS' TOOLS AND SPECIALTIES

"Nicholson File Co's" Files and Rasps, "Double Ender" Saw Files, "Slim" Saw Files, "Racer" Horse Rasps, Handled Rifflers, Machinists' Scrapers, File Brushes, File Cards, Surface File Holders, Vise File Holders, Stub Files and Holders, Improved Butchers' Steels.

Manufactory and Offices at PROVIDENCE, R. I., U. S. A.

TESTIMONIAL ON THE MERITS OF THE

PATENT NICKEL-SEATED "POP" SAFETY VALVE.

PITTSBURGH, April 10th, 1882.

C. A. MOORE, ESQ.,
PREST. CONSOLIDATED SAFETY VALVE CO.,
111 Liberty Street, NEW YORK.

DEAR SIR:—In reply to your favor of the 7th inst., we would state that in October, 1874, we placed upon our boilers your 3-inch Nickel Seated Pop Safety Valves, which have always done their work satisfactorily, relieving the boilers instantaneously when the steam pressure reached the blowing off point, viz., 80 lbs. We have also furnished your valves to a number of our customers who have been well pleased therewith. The best evidence of which is the fact that after once using your valve they adopted them for their subsequent requirements. Yours truly,

ATWOOD & McCAFFREY.

YOUNGSTOWN, O., April 14th, 1884.

C. A. MOORE, Esq., PREST. CONSOLIDATED SAFETY VALVE CO.,
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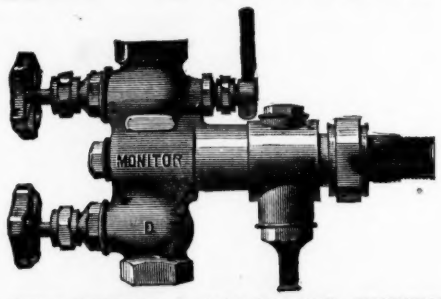

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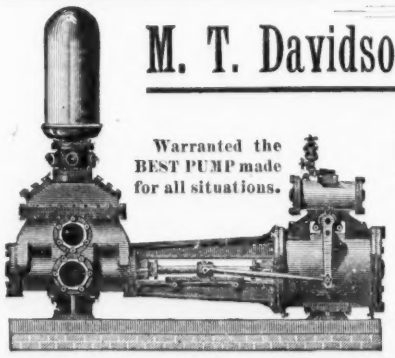

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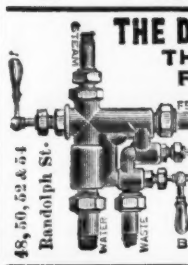

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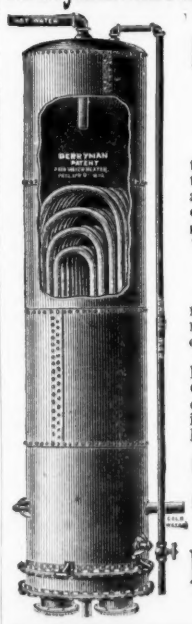

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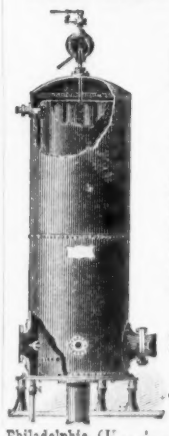

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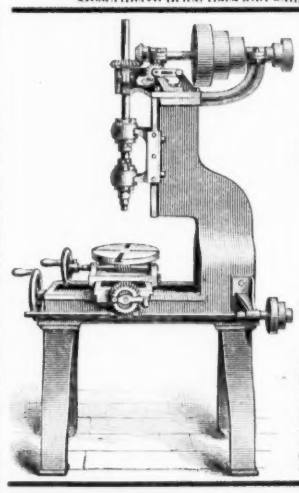

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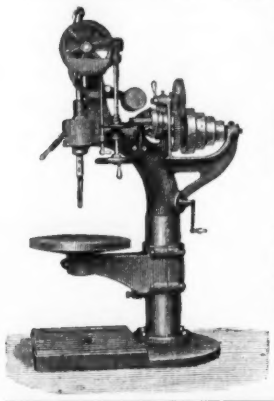

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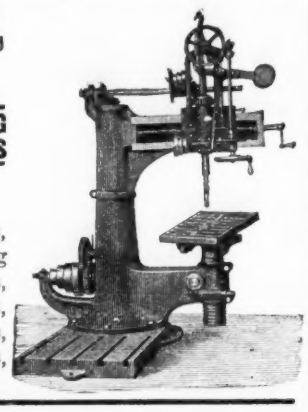

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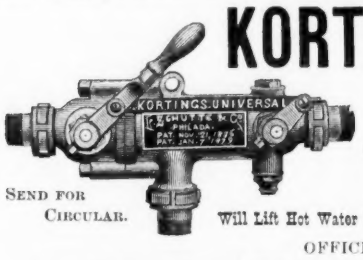

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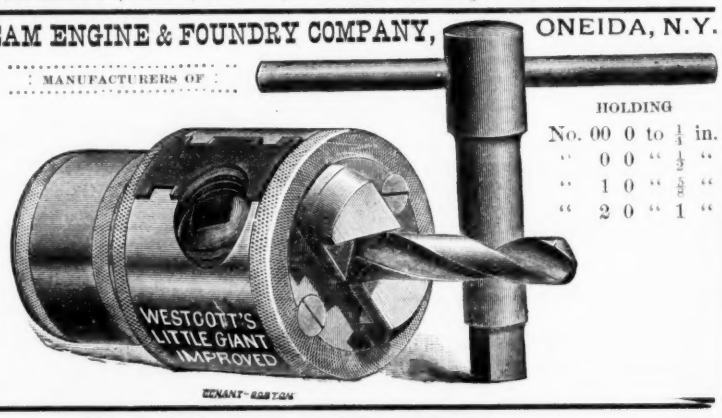

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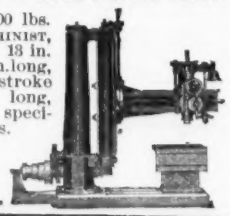

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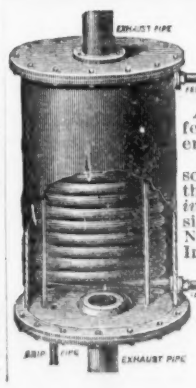

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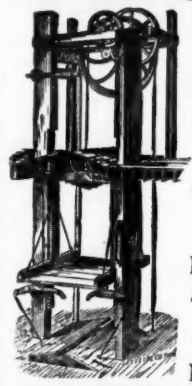

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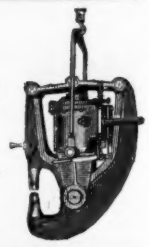

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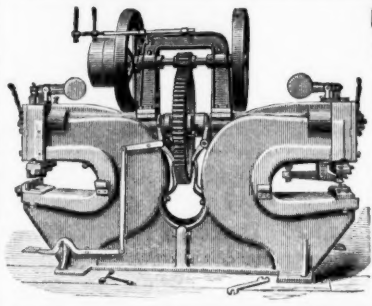

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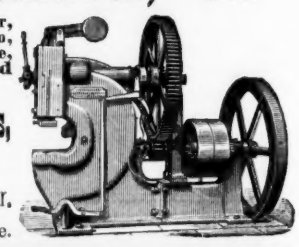

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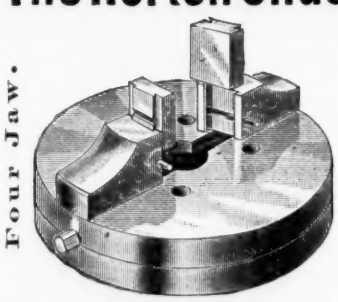

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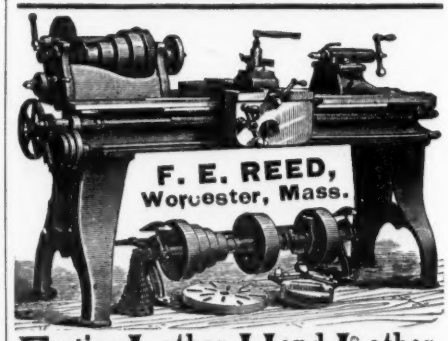

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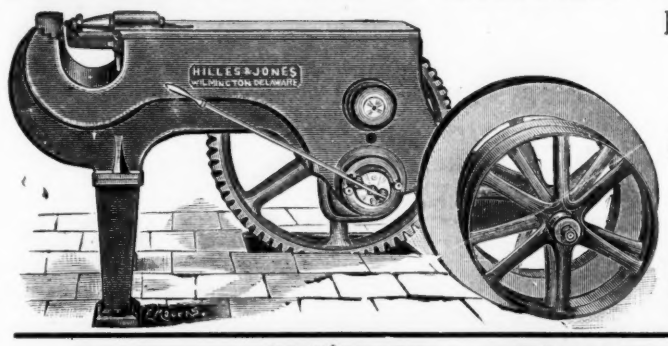

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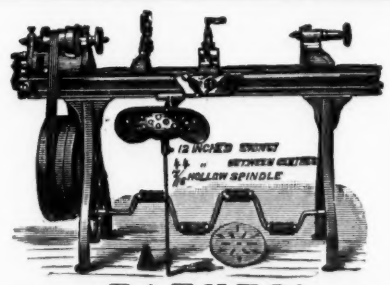

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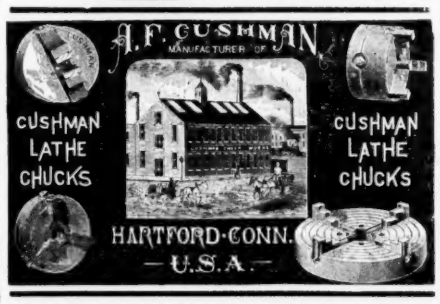

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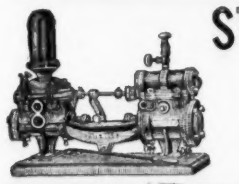

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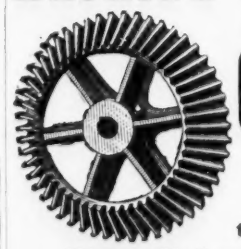

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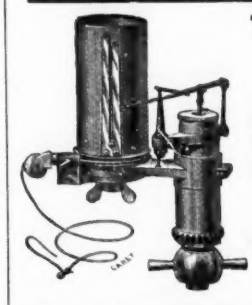

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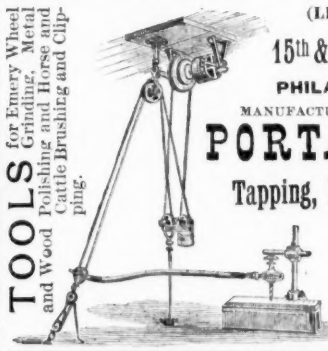

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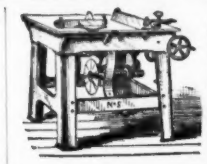

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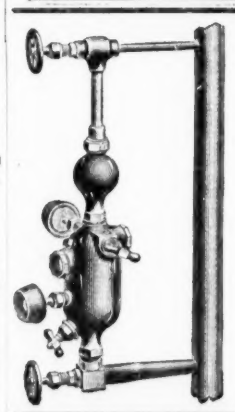

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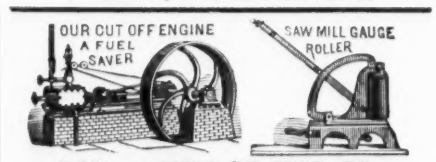

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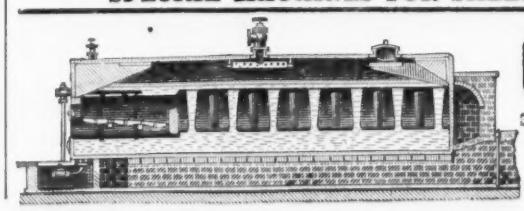

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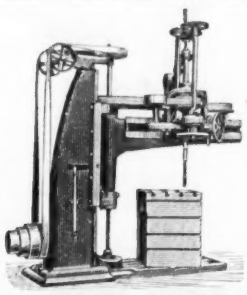

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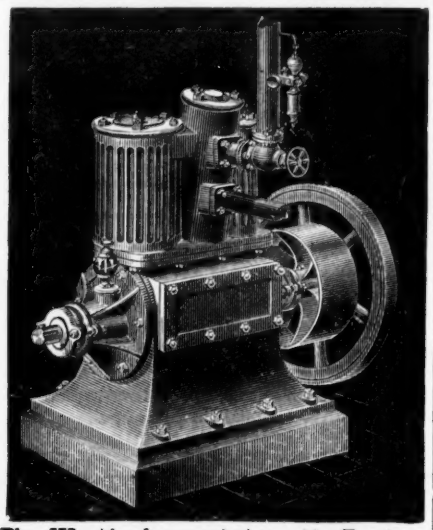

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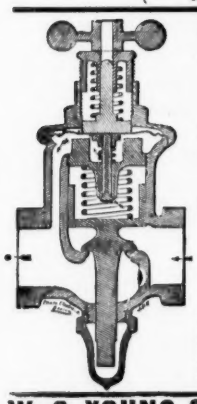

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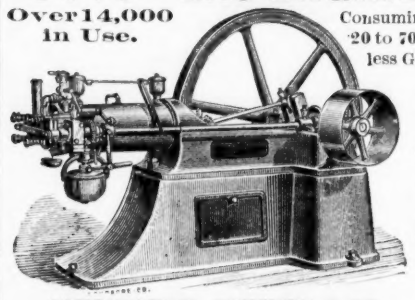

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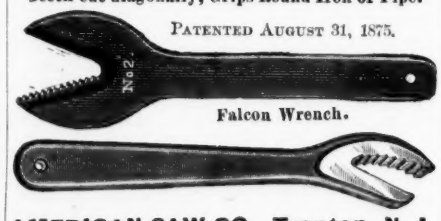

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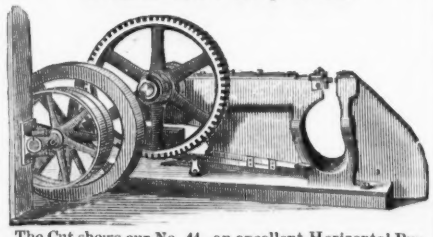

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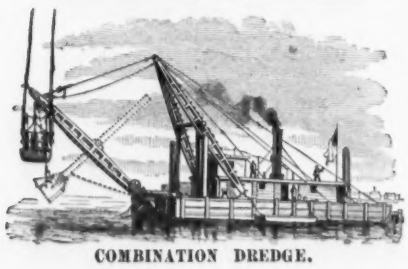

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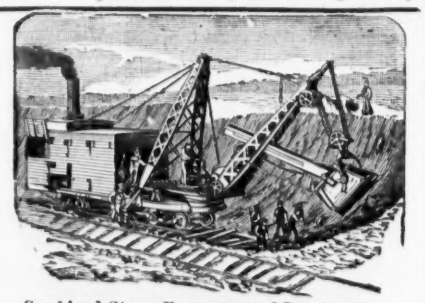

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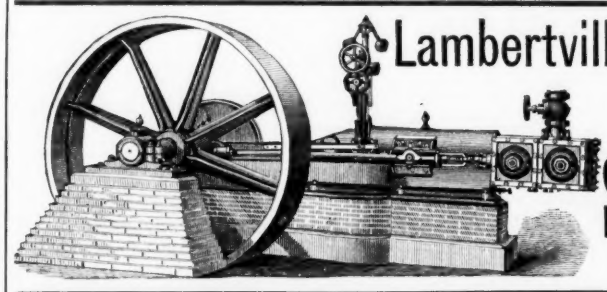

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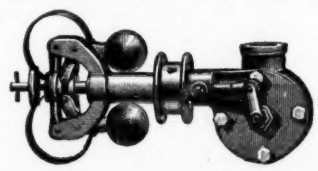

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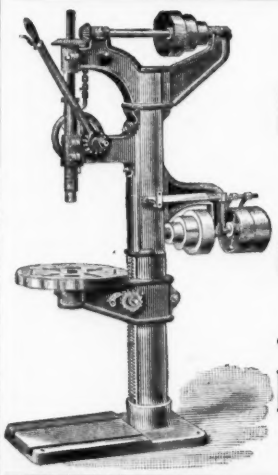

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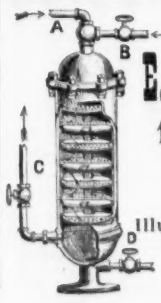

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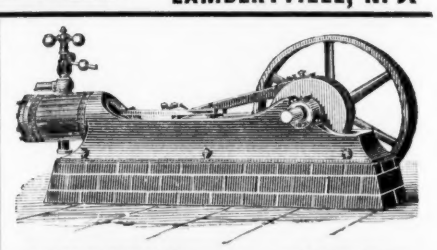

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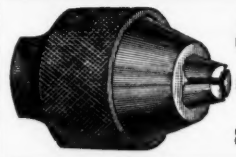

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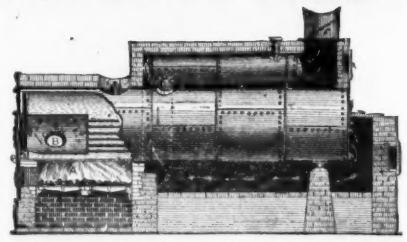

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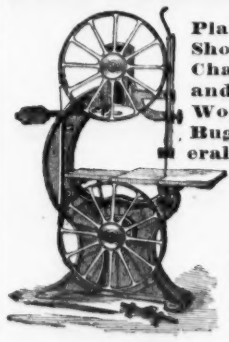

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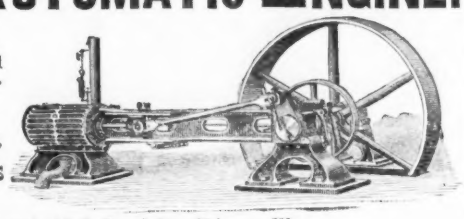

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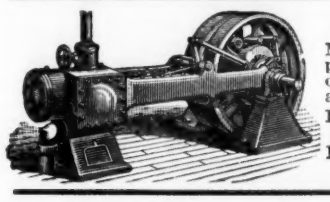

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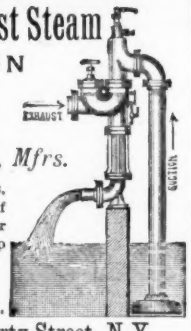

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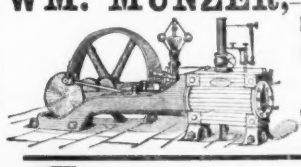

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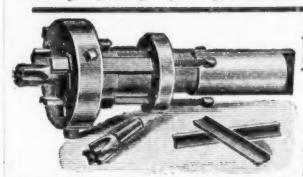

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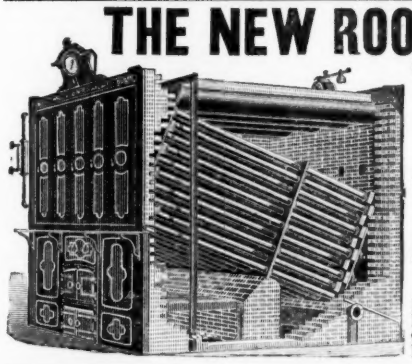

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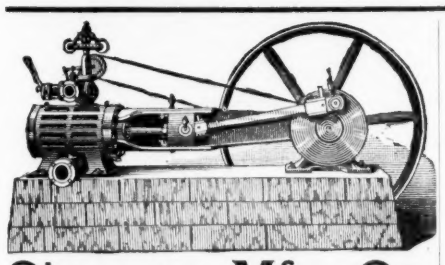

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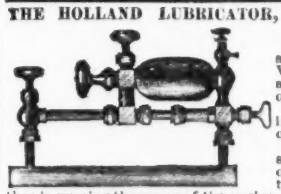

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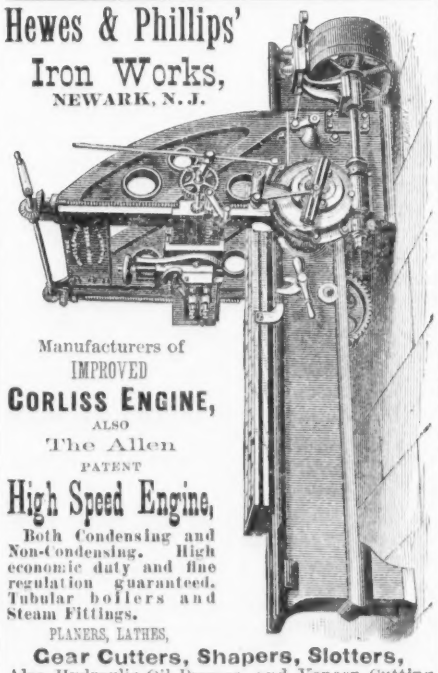

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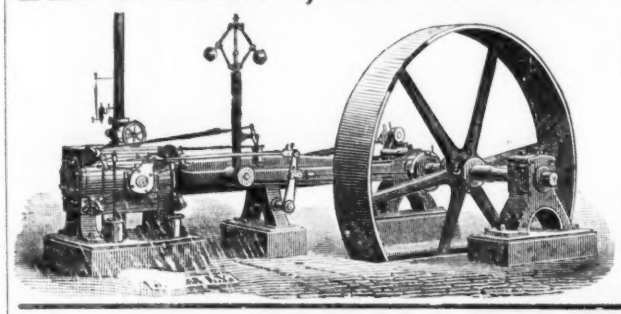

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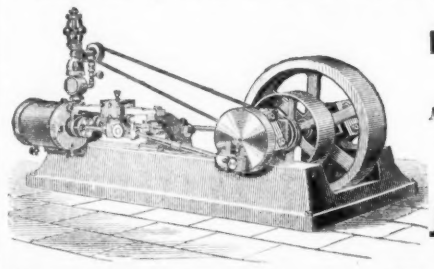

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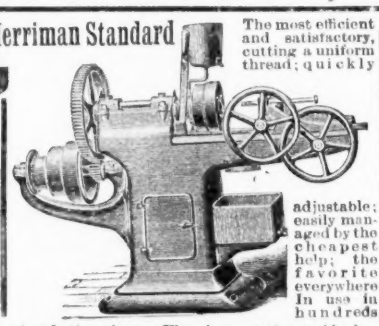

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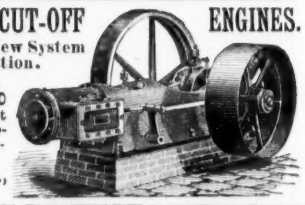

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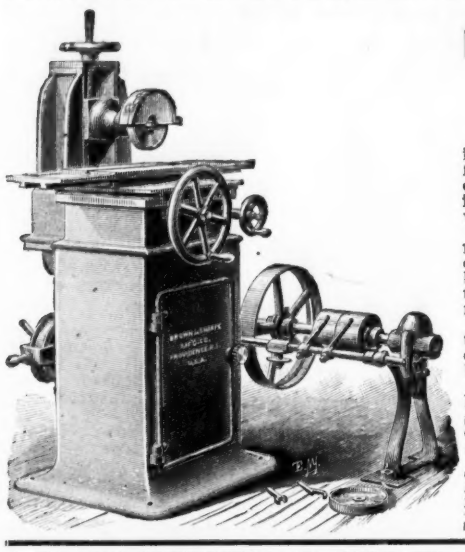

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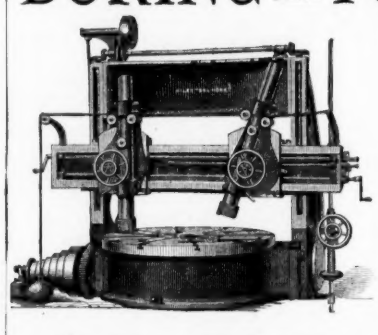

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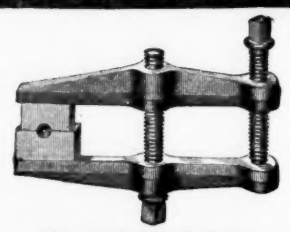

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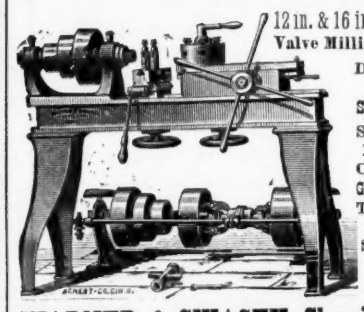

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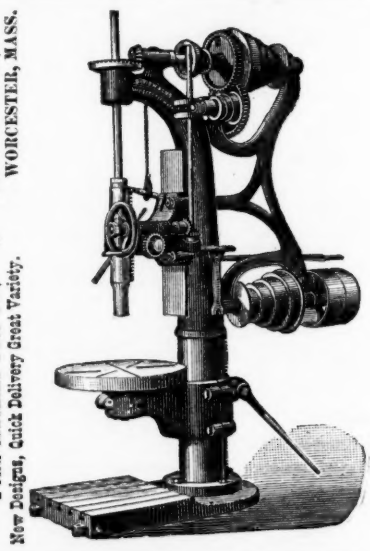

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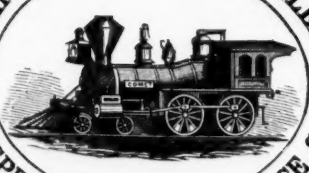

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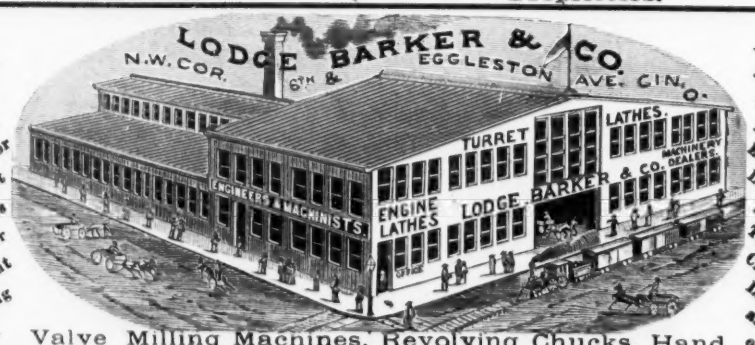
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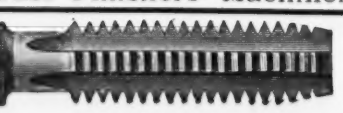

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